MARCH
1959
VOLUME 8
NUMBER 3

Battelle Technical Review

IN THIS ISSUE:

Computers and the Chemical Processing Industry

VIGNETTE

METALLURGIST

J. Harry Jackson

Technologists have found that many of the problems they tackle are determined by the needs and thinking of persons and groups outside their own laboratories. Yet scientists and engineers, in the course of their studies, naturally uncover many problems worthy of investigation. Battelle metallurgist J. Harry Jackson believes that these problems deserve greater consideration when research decisions are being made. In the past few years, he states, numerous problems suggested by his colleagues have proved valuable as bases for sponsored studies. Well aware that technologists have great motivation for productivity when they study self-generated problems, Harry has encouraged the search for original areas of investigation.

When he joined Battelle in 1941, Harry first participated in research in the gray-iron and iron-silicon alloy fields. In the intervening years, his interests and responsibilities have broadened. Though he has been concerned, as manager of the department of metallurgy, with most aspects of metallurgical research, a number of areas have held a very special interest for him. These include: alloys with high electrical resistivity; heat- and corrosion-resistant alloys; special metals-melting techniques; the metallurgy of magnesium and magnesium-base alloys; and the development of other light metals and of the unusual metals. Harry's interest and research in those fields have led to six patents, with five more pending, and to more than two dozen publications. In addition to his strictly technical interests, he is an avid student of research management and of changing concepts of management philosophy.

Along with his research responsibilities, Harry has been active in the work of technical societies. He was recently elected Vice Chairman of the Executive Committee of the Institute of Metals of the Metallurgical Society of the American Institute of Mining, Metallurgical, and Petroleum Engineers. He has helped to establish and served as first chairman of the Institute of Metals' Titanium Committee, the committee on Scope of Technical Committees, and the Council of Technical Committees. Currently he is Chairman of the Handbook Committee on Stainless Steel Castings for the American Society for Metals and has held other posts. He has also been active in the American Society for Testing Materials, the American Foundrymen's Society, and The American Society of Mechanical Engineers.

Harry is a graduate of Rensselaer Polytechnic Institute. His immediate post-college job was as the first welding research engineer ever to be appointed in the metallurgical department of the Caterpillar Tractor Company.

At home, Harry and his wife Marian share the joys and woes of their two teenage daughters and son. For recreation Harry's preference is golf, though he is also an ardent photographer.

BATTELLE TECHNICAL REVIEW

VOLUME 8 • NUMBER 3 • MARCH, 1959

CONTENTS

Inside front cover — Metallurgist—J. Harry Jackson
Vignette

2 — Assuring Research Accuracy

3 — Computers and the Chemical Processing Industry
by ALEXIS W. LEMMON *and* BENJAMIN B. GORDON

The authors review the potentialities of computers in the chemical engineering field ranging from basic studies to the control of automatic plants. Interest in the latter, they believe, should not obscure the contributions that computers can make in pilot-plant operations, process studies, equipment design, and other areas.

9 — Ultrasonics and Welding
by JOHN N. ANTONEVICH *and* ROBERT E. MONROE

Ultrasonic energy has provided us with one of the more promising new metals-joining techniques and with the means for improving existing welding methods. Currently, ultrasonic welding is in limited use only. Research now under way, however, is expected to give technologists a better understanding of the mechanisms involved and help to hasten the practical application of ultrasonics in welding.

14 — Notes from Battelle

Reports on research activities and developments of interest to science and industry.

18 — Writings by Staff Members

Papers and articles prepared by members of the Battelle staff that have appeared recently in books and periodicals.

121a — Battelle Technical Review Abstracts

Abstracts of articles and papers in a wide variety of technological fields from more than 1350 journals published throughout the world. Abstract selection largely reflects primary areas of Battelle research.

Dedicated to the dissemination of knowledge. Published monthly by Battelle Memorial Institute, an endowed foundation serving mankind through science and technology.

Please address all correspondence about articles, abstracts, subscriptions, and exchanges to: The Editor, Battelle Technical Review, Battelle Memorial Institute, 505 King Avenue, Columbus 1, Ohio.

Accepted as controlled circulation publication at Columbus, Ohio.

Printed in U. S. A.

ASSURING RESEARCH ACCURACY

Accuracy, reliability, and reproducibility, so important in research, are being assured here in a universal (tension or compression) testing machine. As the machine compresses the proving ring (calibrated to 0.1 per cent accuracy), the amount of distortion, which is correlated directly with the load, is indicated electrically. Comparison of the indicated load with the reading on the machine's load indicator, shows the amount of error in the latter. With this ring, which greatly reduces the chance for human error, Lester Metz can calibrate Battelle's machines to an accuracy of 0.25 per cent. ASTM standards require accuracy within one per cent.

Computers and the Chemical Processing Industry

The authors review the potentialities of computers in the chemical engineering field ranging from basic studies to the control of automatic plants. Interest in the latter, they believe, should not obscure the contributions that computers can make in pilot-plant operations, process studies, equipment design, and other areas.

by ALEXIS W. LEMMON, JR. *and* BENJAMIN B. GORDON

THE USE OF COMPUTERS TO provide complete automation of a chemical processing operation is one of the most interesting concepts ever considered by the chemical industry. Computers and computer techniques have been used in many areas of chemical and chemical engineering applications, yet their ultimate adaptation to the complete control of a process or plant operation is still basically in the experimental or planning stage.

Much is known about the steps that must be taken to make various chemical processes automatic. Chemists and chemical engineers have successfully used computers for many more or less limited tasks. The real problem is one of combining the scattered pieces of know-how into integrated systems that can perform efficiently enough to be economically advantageous.

When automatized chemical plants are achieved, the computer will be the "brain", under human guidance, to direct and watch over the processes. How such computers can be used and the areas in which they are likely to be useful will be considered in this article.

COMPUTERS AND THEIR CHARACTERISTICS

There are two basic types of computers—digital and analog. Each type has its own method of functioning, and operates under its own philosophy. Hence, each is adaptable to, and performs most efficiently on, certain types of problems.

Digital Computer

The digital computer operates much like the desk calculator, but, needless to say, the computer is much more sophisticated. Like the calculator, it performs repetitive tasks that can be reduced to a routine with great speed and precision. These tasks may be extremely complex and lengthy calculations, but they must be of such a nature that they can be solved by the simple rules of arithmetic. It performs the basic arithmetical operations of addition, subtraction, multiplication, and division. The computer does nothing a fifth-grader cannot do, but it follows instructions exactly, is unlikely to misread numbers, and, of course, operates at tremendous speed.

The computer's capabilities on any particular problem depend on the training, imagination, and ingenuity of the team which writes the instructions or "program". The effectiveness of a digital computer's operation can be no better than the instructions given it. Hence, before a program is written, those responsible for preparing it must be sure that a complete and detailed solution of the problem is possible and that it can be worked out. Also, the solution must be completely possible by numerical methods.

Analog Computers

An analog computer, basically, is an electronic device which uses electrical voltages to represent numerical values. In such a computer, continuously variable values of functions are possible—a contrast to the numerical sequence inherent in the digital computer. "Simulation" is the word that best describes the operation of the analog computer; mathematical equations are simulated by electronic circuitry.

The most important function that can be performed by an analog computer is that of integration. This is coupled with the capability for addition, subtraction, multiplication, and division of voltages to simulate numbers. Thus, differential equations can be simulated and solved without the tedious and time consuming mathematical manipulation and numerical approximation necessary on the digital computer.

Nevertheless, there are several limitations to the use of analog computers. Their operating speed is limited by the electromechanical servomultipliers used for obtaining the product of two variables. A variable changing too rapidly would no longer be represented by the mechanical motion of the servo. However, electronic multipliers are now available which greatly extend the range of frequencies over which an analog computer will operate. The speed is still often limited by the use of electromechanical recorders to record outputs accurately.

Set-up time for an analog computer may be shorter than for a digital computer; however, a library of previously worked out digital programs may often eliminate many hours of labor. Experience will increase the ability of the analog computer operator, but nothing comparable to a program library can be developed.

Although an analog computer can solve a system of differential equations more rapidly than a digital computer, it is true for ordinary differential equations only. If partial differential equations are required for representation of a system, the analog simulation becomes more complex, and frequently the digital computer may be used more economically.

Uses of Computers in Chemical Processing

Computers have been found useful in various phases of chemistry and chemical engineering as well as other branches of science and technology and in many areas of business activity. The usefulness of computers in the chemical process industries has been proved for activities ranging from basic research to plant trouble-shooting. Other applications are being developed as the needs and techniques become apparent. A better understanding of this wide range can be obtained through a discussion of specific applications, techniques, and examples.

Basic Research

Computers have been applied to basic research in the obvious areas of data analysis and correlation. Complex relationships, too complicated in many cases even to be attempted by hand, can be developed by machine. Standard programs to expedite the use of "least squares" and other empirical techniques in performing correlations have been made available for digital computers. Analog computers, on the other hand, seem to be more useful in determining actual behavior. An example will make these distinctions clearer.

In the study of the rates of a chemical reaction, the basic data must be correlated to be of any further value. For some purposes it is sufficient if an empirical relation describing the variation in reaction rate with the important variables (temperature, pressure, concentration, etc.) is available. This type of relation can be obtained conveniently on a digital computer through the use of a least-squares or comparable correlational program.

Alex Lemmon has been associated with Battelle studies of inorganic chemical processes, the thermodynamics of uranium compound reduction reactions, the mixing of paper pulp, and other problems concerned with chemical engineering kinetics and heat transfer. Much of his work has been with theory, correlation, and calculation, and the application of computers has been an important part of this effort. He supervised the compilation of the recently issued *Liquid Propellants Handbook* for the Department of Defense. Before joining Battelle he was assistant professor of chemical engineering at Ohio State University. Earlier he had served as consultant with Arthur D. Little, Inc., on rocket design and development problems on (missile) Project Bumblebee at The John Hopkins University.

Benjamin Gordon is associated with Battelle's Analog Simulation Laboratory. Since joining the Institute staff in 1951, he has been engaged in instrumentation, electrical, and systems engineering research. Along with his responsibilities in connection with the Laboratory, the author has participated in analog-computer simulation studies of reactor-control systems, the operation of internal combustion engines, aircraft dynamics, heat-transfer systems, and servo-control systems.

However, for many design and operational needs, knowledge of the mechanism of the reaction may be required. An analog computer can easily represent the over-all mechanism by simultaneously simulating the various steps in a reaction. Adjustment of the relative importance of each step will result ultimately in an acceptable explanation of the mechanism; it can be further tested and refined as more experiments are performed. The mechanism might also be determined on the digital computer by a trial-and-error process of elimination. To accomplish this, every conceivable mechanism would be formulated and tested against the available data. Acceptable mechanisms would be further tested until the actual mechanisms were determined.

Product Development

Product development and improvement, in the past, required large doses of the "Edisonian" approach. Today the computer simplifies the task. For example, the digital computer has proved effective in improving product properties where a large number of variables were involved. Consider the problem of improving the physical properties of a plastic. Normally, correlation requires many experiments to indicate the direction in which composition changes should be made. Essentially every possible or likely variation must be tried before the maximum improvement can be found. However, experimental programs can also be run on computers. When programs are properly designed, a limited number of definitive conditions may be all that is required. Analysis of these experiments by the computer is usually sufficient to indicate the desirable compositions and their properties. It is then a simple matter to check the predictions by a short experimental program. The resulting improvements can be utilized directly to achieve a better product line, or they may be used again on the computer to refine still further the prediction of the improved composition.

The greater the number of possible variables, the greater, usually, is the value of using a computer to predict the characteristics of better products. Experience in many diffrent areas of research has shown this. Technologists estimate that several years of research effort can be condensed into a few months by using computers. And the savings in dollars are almost as great as the savings in time. The market gains are not so easy to estimate dollar-wise, but the advantages of being early on the market with an improved or new product are rather obvious ones.

Pilot Plant Operation

An important use for computers in pilot-plant studies is in the area of data correlation and analysis. This has previously been discussed and need not be repeated. However, one added advantage should be stated.

Frequently, pilot plants are expensive. The high cost continues at almost the same rate when they are not being operated. Thus, the shortest over-all operating time gives the cheapest over-all operation. Experiments should be performed rapidly, with little lost time between runs, and without false starts or incomplete cycles.

It is clear at this point that the computer would be useful for pilot-plant studies. It can make results and conclusions from an experimental run available almost as quickly as the run is ended. Such efficiency of operation is not attainable in any other way. Moreover, studies can be carried out with greater ease by fewer operating personnel.

A recent example is reported in the literature. A computer program used to analyze the results from a petroleum processing pilot plant was designed to exercise discretion in handling raw data—i.e., reject bad data points on statistical grounds and compensate for occasional missed readings, as well as produce the

Uses for Computers in the Chemical Processing Industry

Research:
Design of Experiments
Correlation of Data
Determination of Mechanisms
Prediction of Optimum Conditions

Development and Pilot Plant Operations:
Data Analysis
Process Simulation
Process Control Studies

Plant Design:
Equipment Design
Cost Estimates

Plant Construction:
Cost Control

Plant Operation:
Product Control
Maximizing Profit
Operation Optimization
Automatic Control
Trouble Shooting

Sales:
Market Surveys
Product Distribution
Inventory Control

desired summary of information regarding the run. The pilot plant was a catalyst-testing unit with various process uses. Two important results derived from a run were data on the catalyst activity and the decline of activity with catalyst on-stream time.

Editing data as part of a manual calculation is no particular problem because it falls in naturally with processing the data. However, scrutinizing tables for omissions and obvious errors, as is usually done, may be more time consuming than the machine computation itself. It is desirable to make the editing in routine processing of plant information, part of the computing program so that raw data from run sheets may be read directly into the computer.

Process Simulation

Several large chemical companies have suggested recently that it might be possible to eliminate the pilot-plant stage in process development by simulating part or all the equipment, on any scale, by means of computers. This thesis has not been verified by any significant number of successful examples. However, it is a logical consequence of the computer applications already being successfully performed.

Such process simulation might follow these steps. It would begin with experiments in the laboratory. The resulting information would be analyzed to explain the basic mechanisms of the chemical process. If this could be achieved and proved on the laboratory scale, the knowledge of the behavior of chemical process equipment would permit simulation on any scale desired. To operate a pilot plant then would require only the selection of the proper scale of operation and the operating conditions which were to be tested. The advantages would be considerable. By simulation alone, a poorly operating piece of equipment could be replaced by another, perhaps more desirable one. Moreover, a large number of alternative designs could be compared quickly, easily, and inexpensively.

The big question—the degree of assurance that can be placed on the results obtained from a computer-simulated pilot plant—has not yet been satisfactorily answered. Getting the answer will probably cause some delay in the possible elimination of many pilot-plant activities in the chemical-process industry. Undoubtedly, much more research will be needed to simulate even some of the simpler processes.

Process Control Studies

Once a chemical process is conceived, the problem of its proper control becomes important. Normally, some elements of the control system for a process are developed during pilot-plant operation; but most instrumentation is specified by the design engineer experienced in similar processes. Then, during plant start-up and initial operations, control points are set; monitoring points are adjusted; and many other necessary modifications are made in the instrumentation. Today, serious difficulties in plant start-up are frequently due to improper or inadequate process controls.

The computer provides the means for building an electronic model of the chemical process to be controlled. Models of several alternative-control systems can also be simulated on the computer. Since the computer model can be operated faster than real time, the control system to be used and the optimum value of the control settings can be chosen in a short time; much less than is required to perform the same functions during actual plant start-up. Use of computers enables this study to be finished before construction of the plant, so that modifications in plant design to facilitate instrumentation and control can be made economically. In addition, the computer model of the chemical process, operating in real time, can be controlled by the actual hardware specified for the plant. Thus the design of the control system can be proved and the operating personnel trained at the same time. This leaves only final minor adjustments to the control systems to be made during actual plant start-up.

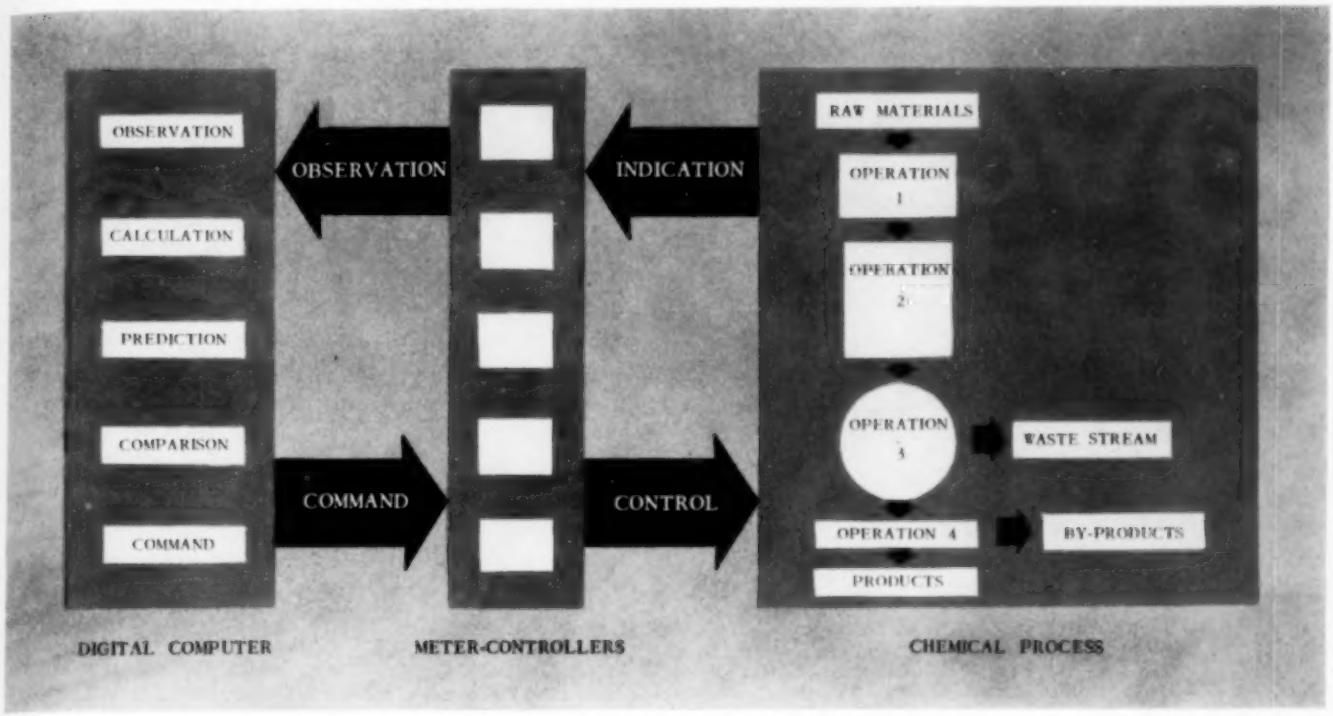
Engineering Design and Cost Estimates

The repetitious calculations required for the design or sizing of many pieces of chemical-process equipment are completely adaptable to computer calculation, particularly digital types. Many companies have available or are developing digital programs for performing the calculations required to design distillation columns, heat exchangers, and several other types of equipment. The economics of this type of computer use have been proved favorable, and such use is expected to expand.

As a logical following step, a number of design groups have, from time to time, proposed that the cost of chemical-process equipment and plants should be estimated by computers. To the authors' knowledge, however, no comprehensive or large-scale application of such methods is being made. The primary reason seems to be the complexity of the problem and thus, the high initial cost of programming it for the digital computer, which of course is the logical choice. An additional reason appears to be the proprietary and competitive nature of cost figures, which precludes a cooperative effort by a number of engineering, design, and construction organizations.

This short discussion serves to illustrate the various areas in chemical processing where computers are useful and are proving to be valuable tools. However, the above examples only scratch the surface of the

HYPOTHETICAL CHEMICAL PROCESS WITH CONTROL AND COMPUTER SYSTEMS



almost infinite specific applications which appear possible.

Automatic Plant Control

The ultimate application of computers in the chemical-processing industry will be to automatic plant control—a logical extension of the simulation and control studies described above. In essence, automatic plant control depends upon the availability of an accurate plant simulation with which to compare the actual operation, or it may be based upon the detailed and intimate knowledge of the interrelations of the many variables. In either case, the proper operation of the plant will depend upon the speed and accuracy with which the computer can (1) determine the present operating situation, (2) predict the future operating situation, and (3) make the necessary changes in the control system (if needed) to assure the desired operation.

Both digital and analog computers will be found useful in achieving automatic control. As a matter of fact, in many cases it may be necessary to utilize both types simultaneously in order to achieve the required results in an efficient manner.

Recently, announcement has been made of a number of pioneer, largely experimental, installations of computers for the prime purpose of controlling chemical processes. Among the processes have been those of: catalytic reforming, dehydrogenation, distillation, and one for the production of vinyl chloride monomer. Computers were specially devised or modified for use in controlling the various processes.

One of the serious problems delaying automatic process control is the need for instrumentation to provide accurate information on some process variables. Thus, meters for measuring temperatures and pressures are adequate; but we have no simple and effective device for determining the chemical composition of process streams. This is an area requiring extensive study.

Description of Automatic Operation

A schematic example of a hypothetical chemical process and of the control and computer systems required for its operation is shown in the illustration above. Signals representing the conditions (temperature, pressure, composition, etc.) existing in various parts of the process would be metered by instruments and reported to the computer. In operation of the system, the conditions at any time are observed by the computer and utilized to compute the required changes in the operating variables. When the required changes are known, the command links can be activated and the operating conditions can be changed by means of the process controllers, thus achieving the objectives without human interference.

Of course, this example has been simplified for purposes of discussion. Also, the example presented is

not unique; there are many possible variations in this system, and many other systems are amenable to automatic control. Each variation and system will have different desirable characteristics, and each may prove optimum for a specific application.

Criteria for Optimization

In the discussion of the example, the term "desired optimum operation" was used in a somewhat blithe and carefree manner to indicate an operational condition that would be best for some reason or other. The best condition is almost always defined as a certain economic condition, and this economic condition is almost always the requirement for maximum profit. It is fortunate that the computer can handle the maximum profit requirement in complex forms. It can be instructed to predict and consider consumer demand for co-products as related to the time of the year for example. Or, the best blend of raw materials as determined by their prices and the yield obtainable from each can be factored so as to yield the maximum profit. Thus, if the computer is given instructions and information upon which to act, it is capable not only of controlling the process, but also of determining the optimum economic operating conditions.

Conclusion

Many problems associated with the use of computers in the chemical industry remain to be solved. But a beginning has been made, and we can expect that more and more processes will be placed under computer control. Yet, process control is only one aspect of the usefulness of this instrument. As pointed out above, computers can aid in basic research, product development, pilot-plant operations, process studies, equipment design, and cost estimations. In each of these areas, the use of computing equipment can reduce the time required at each step and reduce the costs that are an inevitable part of developing chemical processes.

With the growth of knowledge about this development, the bases of the economic advantages of computer use are becoming clear. It appears now that savings in labor costs will be unimportant. The real gains will arise from highly efficient operations—maximum productivity from plant investment with minimum operating costs. More experience is needed, however, before the true worth of computer use can be evaluated. Naturally, data from the pioneer efforts now under way will play a significant role in guiding future developments.

What are the steps for preparing to make use of this potentially valuable instrument? Obtaining a computer by rental or purchase is one step. But much more important is the development of a staff capable of handling such a development. To be effective, a staff must understand the computer as well as the processes with which it is to be linked. The technologists must be able to think in terms of the computer, its capabilities, and limitations, and they must achieve a philosophy of the instrument's use. The next step, of course, is that of developing the systems (and often individual components) that will make the control of specific processes possible.

Computers are here to stay. As we learn to utilize them more fully, we can expect them to contribute to the growth of the chemical-process industries and to the improvement of our standard of living.

THE SCIENTIST AND SOCIETY

"I would suggest the precious quality which the scientist can offer to his community and to his society is the habit of integrity which derives from the scientific approach. Certainly, . . . the scientist is concerned with the search for truth. He wants no preconceptions, no prohibitions, no prejudices to blur his vision or to divert his search. Society needs his doubts and his venturesome instinct, his willingness to dissent and his refusal to conform. It needs them not only in the confines of his laboratory or university or his own company plant or research center, but also in the broad area of political, social, and economic action."

John J. McCloy

1. *Preparing specimens for ultrasonic welding. The specimens to be welded are placed upon the cylindrical anvil, which, by means of compressed air, clamps them against the welding tip. The tip is coupled to a magnetostrictive transducer (right) which provides the vibrational energy. The dial of a timing mechanism for controlling the length of the welding cycle is behind the technologist's arm.*

ULTRASONICS AND WELDING

Ultrasonic energy has provided us with one of the more promising new metals-joining techniques and with the means for improving existing welding methods. Currently, ultrasonic welding is in limited use only. Research now under way, however, is expected to give technologists a better understanding of the mechanisms involved and help to hasten the practical application of ultrasonics in welding.

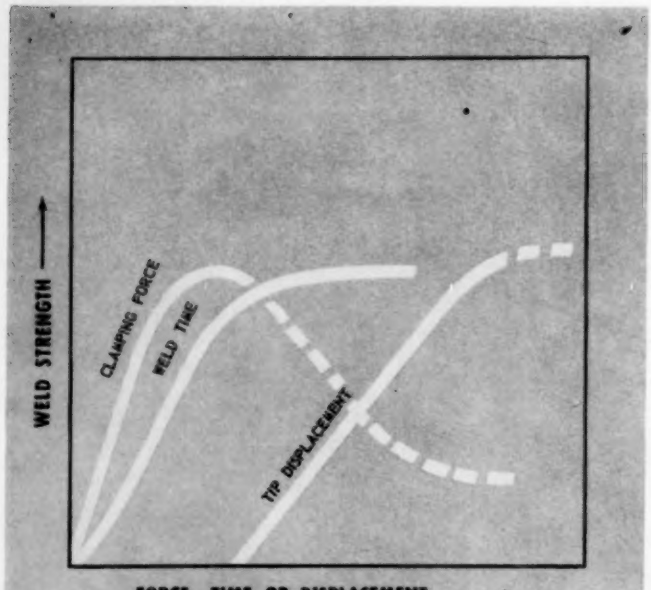
by JOHN N. ANTONEVICH *and* ROBERT E. MONROE

WELDING BY MEANS OF ULTRASONIC vibrations is one of the newest techniques for joining metals. Indeed, most of the research on ultrasonic welding has been done in the last five years, and technologists still have much to learn about this metals-joining method. Its discovery led to early experimentation with various metals in a rush to learn how useful the technique might be. More recently, however, scientists and engineers have been carrying on studies that will lead to better understanding of the mechanisms involved.

Ultrasonic welding was accidentally discovered when the use of ultrasonics was being studied in connection with resistance spot welding. The technologists found a weld produced when the electrode of the spot welder was ultrasonically excited and while the welding current was turned off. Investigation showed that the weld had been caused when the vibrations from the electrodes were induced into the specimen being joined.

BASIC MECHANISM OF ULTRASONIC WELDING

The basic mechanism of ultrasonic welding can be understood by considering what happens when two pieces of metals are placed in sliding contact. The re-



2. *Relationship of clamping force, time, and welding tip displacement to weld strength.*

moval of materials from surfaces sliding under pressure has been attributed to the welding of the peaks on the surfaces of the metals. The reasoning goes like this: high yielding pressures exist where the peaks make contact and the heat is generated by the sliding friction. As a result of the intimacy between the two surfaces, a bond is formed and welding takes place. The bonding mechanism is thought to be recrystallization and/or a fusion process at the interface. It is such welding that appears to account for the galling and seizing betweeen two metal surfaces that so often plague the engineer. The mechanics of the phenomenon might be considered a slow-motion counterpart of ultrasonic welding.

In ultrasonic welding, the surfaces to be joined are made to slide in contact under a compressive force. The force assures intimate contact by removing oxide layers and surface peaks; the work done in sliding heats the interface to a point where the metals will inteact and join. This metallurgical interaction may be fusion between the surfaces of the materials or cohesion from intimate contact, either of which appears to destroy the interface.

Factors in Ultrasonic Welding

The joining job to be done largely decides the design of ultrasonic welding equipment. The accompanying sketches, for example, illustrate the variations in equipment that now seem to be most effective for spot, butt, and seam welding. The basic parts of the equipment are obviously similar.

An arrangement for clamping together the parts to be welded (usually hydraulic, pneumatic, or electromagnetic) is important to the ultrasonic welding process. It provides the compressive force, which along with the heat created by vibration, make the weld possible.

The heart of the ultrasonic welder, of course, is the transducer, or source of vibrational energy. Because the amount of energy needed for welding varies from material to material, a controllable source is absolutely essential. Magnetostrictive transducers are usually favored for their high-mechanical strength and durability. However, designers may also choose from electrodynamic, fluid dynamic, piezoelectric, and electrostrictive transducers.

In welding, the energy must be transferred from the source to one of the parts to be welded. As illustrated in Figure 3, couplings used to transmit the energy are generally of two types, frictional and mechanical. Frictional couplings are effective in seam

John Antonevich has participated at Battelle in many studies involving applications of ultrasonic energy. Along with his co-author, he is currently engaged in research on the basic mechanisms of ultrasonic welding. Earlier, he investigated the effects of vibrational energy upon the grain structure of metals in arc welding. He has studied the applications of ultrasonic energy to the impregnation of materials, the dispersion of materials in chemical and metallurgical processing, and to the machining of metals. The development of ultrasonic equipment has also engaged his attention. Prior to joining the Institute in 1953, Antonevich was associated with experimental electrical engineering studies in home appliances, fractional horsepower motors, and synchro-units for aircraft.

Robert Monroe has been engaged in welding research of broad scope since he joined the Battelle staff in 1950. In addition to the current study of ultrasonic welding, he has participated in the investigation of such challenging problems as the welding of refractory metals (including zirconium, beryllium, molybdenum, and columbium), the development of inert-gas-shielded and controlled-atmosphere welding technique, and the devising of automatic welding methods. Monroe has also been associated with the development of arc-metal spraying techniques and studies of the basic mechanisms of the cone-arc welding process.

and spot welding, but a mechanical coupling is usually preferred for butt welding. Since vibration quickly fatigues metal, time is an important factor in ultrasonic welding success. Such welding cycles are usually very short, rarely lasting longer than about three seconds. For this reason, timing mechanisms are generally used to control the length of the cycle.

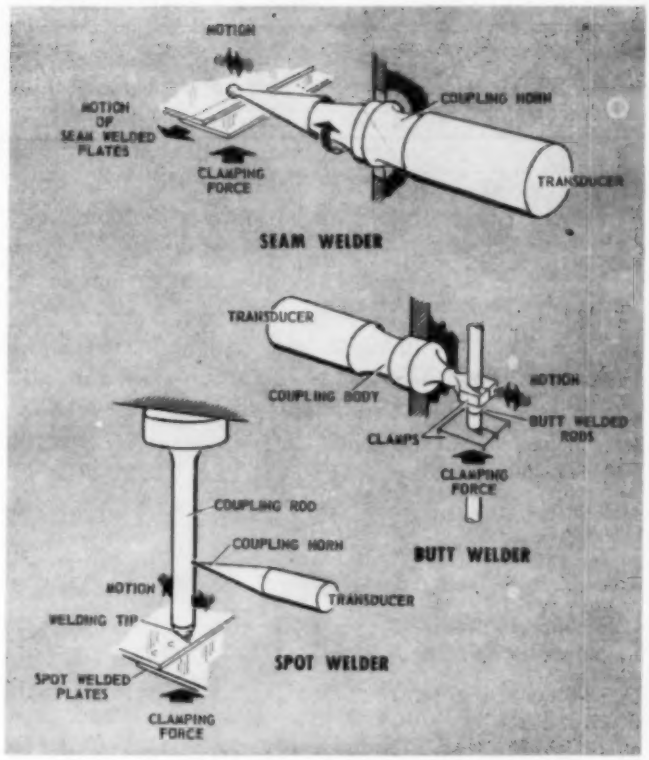
Aside from the physical and mechanical properties of the metals to be joined, success in ultrasonic welding depends largely upon the relationship between clamping force, displacement of motion, and duration of motion. As shown in Figure 2, weld strength appears to be almost directly related to these variables up to the point of fatigue at the weld site. On the basis of information of this type, simple ultrasonic welding units could be designed for specific materials and configurations. With such units, by holding two of the three variables constant during a welding cycle, the technologist could control weld strength by regulating the third variable.

We need to learn more about the practical limitations of this welding process. Thus, studies of the relationships between the properties of materials and their weldability by ultrasonic or frictional methods would be particularly helpful. Such data would enable technologists to formulate general laws in the field, bringing the advantages that usually follow when an art becomes a science. Then equipment could be developed on established principles and more quickly find its way into industry.

Applications of Ultrasonic Welding

Studies to date have given us limited information about what is possible with ultrasonic welding. We know that butt, seam, and spot welds can be made to join small components of thin-gage sheets of moderately ductile materials such as mild steel, iron, aluminum, copper, and gold. Very ductile materials, on the other hand, will yield under ultrasonic strain without interfacial sliding. Hard brittle materials will tend to fatigue under strains necessary for welding.

When one attempts to weld two pieces of lead in an ultrasonic welder, the lead will continuously yield; the energy at the weld-tip interface is dissipated as heat in the adjacent lead layer; and the lead is frequently extruded from beneath the weld tip. Little or no energy would be dissipated at the lead-lead interface. On the other hand, attempts to join sheets of hard materials such as molybdenum will generally lead to different difficulties; the sliding and high-heat dissipation at both the weld tip-molybdenum and molybdenum-molybdenum interface leads to welds at both interfaces. Because the strain required to produce



3. *Basic arrangements in ultrasonic welding.*

a weld is high, the molybdenum may crack about the weld joint.

These limitations are of course based on current concepts of ultrasonic welders. It is conceivable that research will lead to new welding concepts which would extend the application of the process. Applications ranging from tacking or seaming of foils to current pressure welding and resistance welding applications may be possible by ultrasonic techniques.

All materials which can be pressure welded can probably be ultrasonically welded. Where material costs or customer appeal are important, therefore, ultrasonic welding may well replace pressure welding. The small amount of surface indentation caused by ultrasonic welding would reduce the amount of excess material generally required in pressure welding to accommodate yielding loads and to give strength to pressure welds. Greater customer appeal would also be a benefit of the improved surface appearance.

An enticing potential of ultrasonic welding is its possible application in the joining of dissimilar metal combinations. Extensive melting and diffusion take place if dissimilar metal joints are made by conventional fusion welding techniques. These promote the formation of intermetallic compounds in many metal combinations, producing joints with extremely low ductility and shock resistance. Contamination of the weld and base metal may also occur during fusion

TABLE 1. PROPERTIES OF ULTRASONIC SPOT WELDS(e)

Weldment(a)	Tensile-Shear Load at Failure, pounds	Cross-Tension Load at Failure, pounds	Ratio, Cross-Tension Load to Tensile-Shear Load	Maximum Tensile-Shear Load Obtained, pounds
Aluminum to Aluminum (1100-HlB, 0.040 in. thick)	445	85	0.191	500(b)
Titanium to Titanium (MST Grade III, A-70)	440(c)	105(c)	0.240	440(c)
Titanium to Titanium (6Al-4V, 0.025 in. thick)	1220	260	0.21	1230 ± 60
Titanium to 316 Stainless Steel	200	20	0.10	350
Molybdenum to Molybdenum (0.5% Titanium alloy)	60	nil	nil	60
Molybdenum-0.5% to 316 Stainless Steel	120	10	0.083	190
Columbium to Inconel	125	10	0.080	145
Columbium to 316 Stainless Steel	90	5	0.056	100
Columbium to Iron to 316 Stainless Steel	175(d)	50(d)	0.286	175(d)
316 Stainless Steel to 316 Stainless Steel	—	—	—	440 ± 50

(a) All material 0.015 to 0.020 in. thick except as noted.
(b) No failure, limit of test machine.
(c) Failed by shearing nugget from both sheets of titanium.
(d) Iron was pulled out in both the columbium and stainless steel.
(e) All weldments made at same conditions.

welding and drastically affect the weldment properties. Such disadvantages are not found when ultrasonic welding is used.

Currently, one company is using ultrasonic-welding techniques to join insulated electrical leads for ribbon coil transformers. Joints are made between aluminum coated with insulation and copper foil. The insulating material is quickly destroyed by vibration, enabling welding to take place.

During recent investigations into the welding of various heat-resistant metal combinations, no intermetallic compounds were noted in the dissimilar metal joints. Table 1 summarizes the strength of the joints studied and includes data of other investigators. Figure 4 shows a portion of an AISI 316 stainless steel to iron to columbium weld. These are representative of sections found in dissimilar metal joints made by current ultrasonic-welding techniques. Further investigations may lead to procedures for producing welds in small gage sheets of heat-resistant metals possessing acceptable strengths.

The usefulness of ultrasonic welding appears to be limited to spot or seam welding of thin-gage sheet material. On the basis of studies to date, this appears to be an inherent limitation imposed by the mechanism of the welding process. However, if the mechanics of the process are combined with those of other welding techniques, the use of ultrasonic energy in the field of welding could be greatly extended.

Ultrasonics in Other Welding Processes

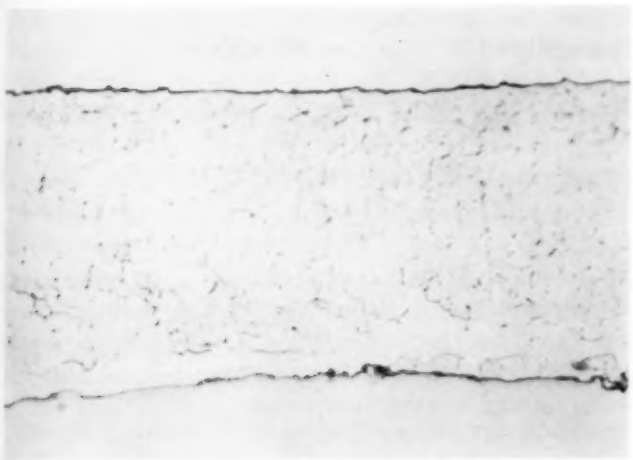
Ultrasonic welding as it is known today can be considered as an improvement of pressure- or cold-welding techniques through the use of ultrasonic energy. Joints produced through fusion in processes such as resistance welding, arc welding, and brazing might also be improved if vibratory energy were added during the joining processes.

Recent studies have suggested some of the important phenomena associated with ultrasonics which could prove beneficial in metallurgical processes, particularly in arc-welding processes. Among the benefits are: grain refinement in solidifying melts, degassing of melts, and reduction of surface tension of molten metals. However, a number of problems may have to be solved before practical adaptation of ultrasonics to arc-

welding techniques can be realized. Technologists have found that:

1. Ultrasonic vibrations increase cooling rates of molten metals, and the short periods that welds are plastic may not offer ample time for ultrasonic effects to occur.
2. Energy levels required to produce given effects may be high, thus making it difficult to couple vibratory energy to the weld zone.
3. Reaction rates are generally increased in the presence of ultrasonic vibrations which may accelerate phenomena such as hydrogen embrittlement or undesirable alloying.

In the cases of resistance welding and brazing, vibratory motion at the interface would remove the oxide and other surface contaminants to provide intimate metal-to-metal contact. The improved contact would reduce both the entrapped gas and suface contaminants at the interface that can react or be dispersed in the molten zone during welding. This would increase the strength of the final joint. The alternating stress and strain in the hot weld zone during solidification could inhibit dendritic grain growth.



4. *Photomicrograph (500X) of a weld of (from the top) stainless steel to iron to columbium, showing what is possible in joining dissimilar metals by ultrasonic methods. The welding was done under a clamping force of 300 pounds, with a welding tip displacement of 1.7 mils, and a cycle lasting one second.*

Similarly, grain growth could be inhibited in arc welds. In addition, porosity due to included gas would also be eliminated through the degassing effect of ultrasonics. The apparent reduction in surface tension due to ultrasonics should also improve wetting of surfaces being welded so as to give better bonds or eliminate possible unwelded areas in weld seams.

Grain reduction during resistance and arc welding have been observed when ultrasonic energy is applied. Recent studies into the effects of ultrasonics on arc welding of tantalum, for example, have shown that grain refinement occurs. An ultrasonic technique for refining grains and eliminating striations in arc-cast ingots has been found successful.

Conclusions

The significance of vibratory energy in the field of welding has been recognized frequently. Unfortunately diligence in pursuing significant metallurgical aspects of ultrasonics related to welding problems has been lacking. A critical review and assimilation of (a) metallurgical phenomena associated with vibratory energy, (b) the major problems encountered in joining metals, (c) the transducers developed in recent years for generating vibratory energy, and (d) the adaptability of the transducers to welders, would show many possible approaches for expanding the science of welding and possibly lead to immediate equipment designs for joining problem materials.

Practical application of ultrasonics to welding is currently limited to the ultrasonic-welding process. This process has been satisfactorily used on aluminum sheet up to about 0.090-inch thick and on thinner gages of other metals and alloys. At present, this thickness limitation, which applies to only one sheet, is a very real limitation to the process. The increased probing into the "whys" of the ultrasonic-welding process should produce a much firmer knowledge from which to evaluate the process potential in the near future.

"In more primitive times was coined the aphorism that necessity is the mother of invention. Man needed wheels, so he devised them. Today *research* is the mother of invention, because we do not *need* things we do not have. We just discover, through our intellectual curiosity in technological fields, that we can make things we never had before and never missed. The premium, in our industrial civilization, is not on what we need, which requires an inventor, but on what we can make, which research scientists are revealing every day."

Lawrence R. Hafstad

NOTES from BATTELLE

* MATERIALS FOR PELTIER COOLING

There have been predictions recently that refrigeration and air conditioning may soon be accomplished on a large scale by electronic units without either the moving parts or chemical coolants used in present-day appliances. These predictions are based on the assumption that improved thermoelectric-cooling materials can be developed. Research to broaden science's knowledge of materials and techniques required for thermoelectric-cooling devices has just been started at Battelle. Initially, the two-year program is being sponsored by 16 American industrial firms interested in research basic to the use of the so-called Peltier cooling effect for refrigeration.

The Peltier or thermoelectric-cooling effect is achieved when electric current causes heat to be absorbed at one junction of two dissimilar materials and released from another junction of the same materials. Devices utilizing the Peltier effect require extremely pure materials having a closely controlled combination of electrical properties.

The basic objective of the new research program is the preparation of new compounds and investigation of their resistivity, thermal conductivity, and thermoelectric power. Materials to be studied will be chosen from the following chemical systems: compounds of copper, silver, and gold with sulfur, selenium, and tellurium; compounds of zinc, cadmium, and mercury with arsenic, antimony, and bismuth; and compounds of alkaline-earth metals, such as magnesium and calcium, and of alkali metals, such as sodium and potassium, and germanium, tin, lead, arsenic, antimony, and bismuth. In addition, combinations of these compounds in alloys will also be studied.

Dr. E. H. Lougher, who will coordinate the research at Battelle, stated, "The study will concentrate on the thermoelectric properties of materials which have thus far received relatively little attention for thermoelectric devices. Materials that have already been investigated extensively, such as bismuth telluride, are not included in the present study."

The Battelle chemist said that the new research program is the result of "what was, in effect, a general invitation from Battelle for industry's support of much needed research in this area". He indicated that it is anticipated that additional companies will join in the sponsorship of this research as the program progresses.

Companies sponsoring research initially include: American Motors Corporation; Carrier Corporation; Chrysler Corporation; Fedders Corporation; General Motors Corporation; Hamilton Standard Division, United Aircraft Corporation; Lockheed Aircraft Corporation; The Martin Company; Monsanto Chemical Company; National Carbon Company, Division of Union Carbide Corporation; Ranco Incorporated; Robertshaw-Fulton Controls Company; Tecumseh Products Company; Texas Instruments Incorporated; Westinghouse Electric Corporation; and Whirlpool Corporation.

Specialists from both Battelle's solid state devices division and physical chemistry divisions will be called upon to assist in the thermoelectric-cooling research program. They have been engaged in research on thermoelectric materials, including lead telluride and its alloys, for the past eight years. For three years, they have also been conducting research on bismuth telluride and related compounds.

* CHECKING THE PMPC REPORT

How are the conclusions of the 1952 report of the President's Materials Policy Commission holding up? The report, *Resources for Freedom*, included studies of possible changes in the materials supply situation in the United States, and how technological developments might affect the picture, to 1975. The studies were based on data available in 1950.

An examination of the available data to 1958, as they relate to the portion of the report dealing with production of ferrous materials and the supply of iron- and steel-making raw materials, has been made by John D. Sullivan of Battelle. He presented his findings last month before the Council of Economics of the American Institute of Mining, Metallurgical, and Petroleum Engineers at its Annual Meeting. A brief summary of Dr. Sullivan's findings is presented on the following page:

• A comparison of an interpolation of statistical data on the production of ferrous materials and on the supply of iron- and steel-making raw materials with the actual values of 1957 shows that no gross errors were made. Differences are of degree rather than of kind . . .

• The PMPC report was pessimistic about the supply of obsolescent scrap for the anticipated expansion of steel production in the 1950's. The true story of obsolescent scrap was not known until the intensive study made by Business and Defense Services Administration, Department of Commerce and Battelle Institute and published in 1957. This realistic report shows that the potential supply of obsolescent scrap is currently ample and sufficient for domestic needs and reasonable exports, and that it likely will be until 1975.

• Better information on the properties needed in a blast-furnace coke, particularly at the temperature of use, has made the coke supply situation appear more favorable than might be inferred from the Paley report. Sulphur content remains a problem.

• The PMPC report was not too concerned about the supply of additive metals such as manganese, nickel, chromium, cobalt, vanadium, and columbium. While there was a shortage, particularly of nickel, a couple years ago, these conclusions appear to be sound, particularly with new supplies becoming available.

• Improvements have been made in blast-furnace production of pig iron. Part of this is due to better preparation of the feed; part to better ores . . . The low-shaft furnace, predicted by the Paley report as likely to find greater use in the United States, is now of minor interest here . . . Direct-reduction processes are still in the development stage. Most large steel companies are investigating some process. With more fines in iron ores, and with some ores that tend to disintegrate in the blast furnace, there is more incentive to develop direct-reduction processes. However, they will have no impact on the industry before 1965.

• The PMPC report predicted that the basic open-hearth process will lose its dominant position in the Nation's steel industry by 1975. This appears to be an unfounded prediction. Of the total steel produced in the United States, the basic hearth produced 89.6 per cent in 1957 contrasted to 88.5 per cent in 1950. The electric furnace, its chief competitor, produced only 7.6 per cent of the total in 1957, a gain from 6.2 per cent in 1950. The Bessemer processes dropped from 4.7 to 2.2 during the same period, but the oxygen top-blown converter may reverse the trend. Also, increased use of oxyygen in the basic open hearth is predicted to permit the use of higher percentages of hot metal in the charge. The acid open hearth remained about stationary, producing less than one per cent of the total.

• Continuous casting and hot extrusion, looked on in the Paley report as likely to grow, have not made major progress to date in the United States.

* CONTROL OF LIQUID METAL FLOW

Precision control of the liquid metal used in continuous casting processes is a perennial problem. The handling of liquid high temperature melting point metals is particularly difficult. Liquid steel, for example, has a temperature of over 3200 F. In a study to develop an effective control method, W. Siegfried and B. Broniewski of Battelle's Geneva laboratory, investigated the advantages of magnetic force. Their specific problem was development of a means for precise control of liquid steel to a rolling mill making welding rods directly from molten metal.

After a study of more conventional control methods, the technologists ruled out several techniques: pouring directly from a ladle onto the rollers which form the rods; the widely used ladle equipped with a stopper rod; and control by cooling the nozzle with water. They turned, then, to the use of a magnetic field moving parallel to a tube to control the flow of metal inside while the field acts simultaneously as pump and heater.

Siegfried and Broniewski also tackled the problem of finding a material that would stand up to liquid steel. The metals, ceramics, oxides, carbides, silicides, and borides they tried were quickly attacked. However, sintered alumina was found satisfactorily resistant to the molten steel.

The tube, in which the metal is magnetically controlled, was then designed. It is of Inconel with a sintered alumina liner. The iron and coils surrounding the tube, and which supply the magnetic pumping action, are cooled by forced air. To prevent cooling of the metal, the tube itself is electrically heated to about 2100 F.

At present, two possible uses for the method can be seen—flow control and instantaneous stoppage of flow. The laboratory installation has proved the effectiveness of the technique for controlling liquid metals. Thus liquid aluminum can be sharply arrested in a

5-foot tube. However, at the present stage, the apparatus cannot instantaneously and absolutely stop the flow of metals. For various reasons, liquid metals form droplets which cannot be retained by present methods. Further study is needed to overcome this problem so that the flow of liquid steel can be absolutely and instantly stopped.

* SELENIUM AIDS STEEL MACHINING

How can the machinability of high-strength, heat-treated steels be improved to make them more useful as structural materials? Studies by Battelle metallurgists indicate that additions of selenium are effective for this purpose. In research for the Selenium and Tellurium Development Committee, they investigated the effects of selenium additions upon the machinability and also the tensile properties of several 5% Cr - 1.2% Mo steels.

As reported by Francis W. Boulger, who guided the research, selenium is more effective than sulfur, on a weight basis, for improving machinability of hot-work die steels. The metallurgists found that the presence of 0.05 per cent selenium improved the ratings of annealed samples by 8 per cent; of bars treated to 330 Brinell hardness, by more than 50 per cent. Larger amounts of selenium or sulfur did little to further improve machining properties.

Combined selenium and sulfur contents of 0.22 per cent or over had little effect on tensile properties of annealed samples. in steel (containing such amounts of selenium and/or sulfur) heat treated to strengths of 278,000 psi, samples taken parallel with the direction of rolling showed little change in ductility. But in transverse samples, the metallurgists found ductility lower. This undesirable effect did not appear in steels containing up to 0.18 per cent selenium and normal sulfur contents.

* HEAT AND ORE GRINDING

Scattered studies over the past 15 years have shown that heat treatment of some ores makes them easier to grind. Experience has shown that such treatment may be carried on by (1) uniform heating, (2) thermal shock (rapid heating to, or cooling from, high temperatures), and (3) chemical reactions at high temperatures in which minerals in ore undergo changes in chemical composition.

Last month, Battelle chemical engineers F. M. Stephens, Jr. and A. L. Wesner, reported on the correlation between various factors that determine grindability of materials. Their paper was presented before the Annual Meeting of the American Institute of Mining, Metallurgical, and Petroleum Engineers. In it they discussed types of thermal treatments, the physical properties that heating affects to improve grindability, and the results of thermal treatment followed by grinding.

Their investigations of the thermal expansion characteristics of minerals emphasize that (1) few natural minerals have the same coefficients of expansion, (2) some do not have the same coefficients of expansion in all directions, (3) some undergo permanent deformation when heated, and that (4) the thermal expansion characteristics of minerals are seldom constant over wide temperature ranges. The Battelle technologists also point out that in chemical reactions, where one or more components of an ore are removed, the treated ore is likely to shrink or to be porous.

Thermal or chemical treatment can significantly change the grindability of ores; however, such treatment is not necessarily the best way to cut grinding costs. Stephens and Wesner believe that in properly designed elevated-temperature systems, reduced grinding costs can sometimes be obtained as a bonus. They also point out that the bonus may make a high-temperature processing step economically practical. This happens when the processing step would cost too much without the saving in grinding costs.

Fourteen atomic-research specialists, from ten nations, recently visited Battelle in the course of a tour of various nuclear facilities. They were participants in the Eighth Session of the International School of Nuclear Science and Engineering sponsored by Argonne National Laboratory. Shown discussing aspects of Battelle's research, with the Institute's Arthur A. Bauer (back to camera) are: (left to right) Satyavolu Lakshmipathi, India; Nasmuddin A. Mufti, Pakistan; Djali Ahimsa, Indonesia; Hideto Kamegawa, Japan; Iwao Kataoka, Japan; U Tun Hla, Burma; Sobhak P. Kasemsanta, Thailand; and Koichi Masaubuchi, Japan.

PROBLEMS OF SOLID LUBRICANTS

Modern high temperature systems, such as aircraft and nuclear, require special lubrication systems that will function at temperatures upward to 1000 F. Few mineral oils will withstand temperatures above 300 F. With very few exceptions, even specially synthesized lubricants are useless above the 500 F range.

In research for the Stratos Division of Fairchild Engine and Airplane Corporation, Battelle technologists studied the effectiveness of a number of dry powdered lubricants at about 1000 F. Their experiments, utilizing a four-ball wear machine, were designed to provide data for predicting friction and wear in components lubricated by the selected materials. The technologists, S. L. Cosgrove, L. B. Sibley, and C. M. Allen, state that metal-free phthalocyanine and other compounds of the phthalocyanine family appeared to have superior lubricating qualities. Of the wear specimens evaluated, AISI Type M-1 tool steel and titanium carbide-nickel-molybdenum cermet showed most promise for high-temperature sliding systems. Initial coefficients of friction less than 0.1 were obtained with these combinations of materials.

The technologists conclude that though the chemistry of solid lubricants is promising, much more research is needed for better understanding of the mechanisms of lubrication by solids. Study, they say, is required on the friction and load-carrying capacity of such lubricants, the conditions affecting the deformation and flow of lubricant materials, the design of wear surfaces, lubricant feed systems, and other problems.

TECHNOLOGY AND SCRAP METAL

The improved processes that have been developed by the iron and steel industry since World War II have important implications for the scrap metal industry. This was the theme of a talk by Battelle economist William L. Swager before the recent Annual Convention of The Institute of Scrap Iron and Steel.

In his presentation, Swager summarized the various developments that have led to increased production of iron and steel from present plants. He discussed the challenge of direct reduction (nonblast furnace methods to convert iron ore to iron) as a possible source of metallics. He considered the importance of the use of oxygen, particularly in the open hearth furnace, in increasing steel production. Such techniques, he noted, make possible the production of steel in the open hearth furnace largely from hot metal (pig iron received molten from the blast furnace). Swager also pointed up the significance of developments such as continuous casting, centrifugal casting, and heat extrusion, which reduce home scrap.

Swager concluded: "Regardless of the specific processes that may be incorporated in plant operations, changing technology will result in increased flexibility of plant operations so that a plant can adjust more quickly to raw material availability and prices and to changes in market demand for steel. . . . Changing purchased scrap except in this way: Increased quality will be demanded of purchased scrap. Scrap volume in the future depends on how well these requirements can be met at prices competitive with alternative materials."

Recent appointments of Battelle staff members to key technical posts include: *Howard C. Cross,* secretary, Joint Committee, American Society for Testing Materials—American Society of Mechanical Engineers; *Lloyd Jackson,* member, Research Advisory Committee on Materials, National Aeronautics and Space Administration; *Howard R. Batchelder, David C. Minton,* and *John L. Gray,* members of the Committees on Nuclear Energy, Research, and Patents respectively, of the National Association of Manufacturers; *Howard W. Russell,* member, Science Information Council, National Science Foundation; *Ralph A. Sherman,* member, International Relations Committee, Engineers Joint Council, representing American Society of Heating, Refrigeration, and Air Conditioning Engineers; *James J. Tighe,* chairman, Data Handling Task Group, American Society for Testing Materials.

For "outstanding contributions to the Society and to metallurgical progress", Battelle's H. W. Lownie, Jr. is the 1959 recipient of the John H. Whiting Medal of the American Foundrymen's Society. Lownie's role in gray cast iron research was given particular attention by the Society in naming him for the award. Chief of the Institute's process metallurgy division, Lownie has participated in and guided studies of properties, applications, and production of gray iron, malleable iron, and steel castings, and contributed to research in other metallurgical processes and materials.

Writings by STAFF Members

American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society, v. 212, no. 6, December, 1958, contains the following articles by staff members:

The Constitution of Zirconium-Uranium Alloys Containing Oxygen or Nitrogen. A. A. Bauer, G. H. Beatty, and F. A. Rough, pp. 801-808.

The extent of the α-plus-β zirconium region in the binary zirconium-uranium system at 660 C has been determined. The phase boundary occurs at 31 weight per cent U. This determination is based upon a quantitative study of zirconium-uranium alloys containing oxygen and nitrogen; the data were employed in extrapolating to zero oxygen and nitrogen content in order to determine the constitution of binary alloys. On the basis of the data obtained, revisions in the constitutional diagrams of the zirconium-uranium and zirconium-uranium-oxygen systems are proposed. A partial zirconium-uranium-nitrogen diagram is presented.

The Constitution of Delta-Phase Alloys of the System Uranium-Molybdenum-Titanium. A. A. Bauer, F. A. Rough, and J. Doig., pp. 862-868.

The phase relationships occurring between the intermediate phases of the uranium-molybdenum and uranium-titanium systems were determined. A ternary cut, based upon studies of alloys ranging in composition from uranium-31.5 atomic per cent Mo to uranium-34 atomic per cent Ti, illustrating these relationships and inferred isothermal ternary sections are presented.

Electrochemical Society, Journal, v. 105, December, 1958, contains the following articles by staff members:

Semiconducting Compounds—A Challenge in Applied and Basic Research. A. C. Beer, pp. 743-751.

The use of a number of semiconducting compounds in device applications is discussed for categories defined by the external field which produces a modulation of the carrier density or mobility. Included are applications based on response to electric fields, magnetic fields, thermal fields, photon energy, and thermal energy. The implications of recent investigations as regards band structure, states densities, charge carrier mobilities, crystal imperfections, and other basic characteristics are presented.

Preparation and Some Characteristics of Single-Crystal Indium Phosphide. T. C. Harman, J. I. Genco, W. P. Allred, and H. L. Goering, pp. 731-735.

A technique for purifying phosphorus, reacting elemental indium, and phosphorus, purifying the compound, indium phosphide, by a directional recrystallization, and growing large crystals all in one glass tube is described. A crystal puller for decomposable solids is described in detail and results for indium phosphide discussed. The electron mobility as a function of temperature is given for two single-crystal specimens. An electron mobility of 4000 $cm^2/v\text{-}sec$ at 300 K for a specimen containing a carrier concentration of $1 \times 10^{17}/cm^3$ was achieved.

Here's Graft Polymerization. It's on the Brink of Commercial Exploitation. H. George Hammon. *Chemical Processing*, v. 21, December, 1958, pp. 93-94.

Grafting refers to the operation of chemically joining two or more dissimilar polymers. Graft polymerization by radiation offers a means of chemically altering a preformed synthetic or natural polymer without changing its physical shape, and often without destroying many desirable properties. Economically feasible applications are cited.

α-β-Unsaturated Ketones. III. Copolymers of Perfluoroalkyl Propenyl Ketones With Dienes. F. B. Jones, L. E. Coleman, Jr., and P. B. Stickney. *Journal of Polymer Science*, v. 33, December 1958, pp. 405-416.

The preparation and properties of copolymers of three perfluoroalkyl propenyl ketones with different 1,3-dienes are described. Emulsion copolymerization at 50 C and at 5 C of perfluoromethyl, perfluoropropyl, and perfluoroheptyl propenyl ketones with 1,3-dienes, such as butadiene, 1,1,2-trifluoro-3-chlorobutadiene, 1,1,2-trifluorobutadiene, and isoprene, was accomplished and many of the products exhibited elastomeric properties. Qualitative determinations of thermal stability and solvent resistance were made.

Pinhole Porosity in High-Alloy Steel Castings. R. J. Mangone, A. M. Hall, W. T. Bryan, and C. E. Sims. *Journal of Metals*, v. 10, December, 1958, pp. 810-814.

The important foundry variables influencing pinhole porosity in stainless-type castings are melt hydrogen content, pouring temperature, and mold-moisture content. Careful control of these major variables will minimize the occurrence of pinhole porosity in castings under normal conditions. Curves that show the relationship between pouring temperature and hydrogen content of the melt at several selenium and mold-moisture contents can constitute a useful guide for improving foundry practice.

Adhesive Bonding of Titanium. H. E. Pattee, C. F. Faulkner, and P. J. Rieppel. *Light Metal Age*, v. 16, December, 1958, p. 22 + 4 pages.

The problems have tended to retard the development of adhesive-bonded titanium structures: adhesives that can be used at elevated temperatures for long periods of time and suitable surface treatments to prepare titanium for bonding. The most promising adhesives are modified phenolic-epoxy resins; however, considerable effort is being exerted to develop ceramic adhesives, organic adhesives, and semiorganic adhesives for high temperature applications. Several surface treatments, such as anodized coatings, vapor plating of aluminum and gold, and acid etching, have been developed to the extent that bond strengths obtained with titanium compare favorably with those obtained with aluminum.

Vapor Pressures and Molecular Composition of Vapors of the $RbF\text{-}ZrF_4$ and $LiF\text{-}ZrF_4$ Systems. Karl A. Sense and Richard W. Stone. *Journal of Physical Chemistry, November* 1958, pp. 1411-1418.

The vapor pressures of RbF and LiF were measured over the temperature intervals 589-1059 C and 851-1060 C, respectively. Vapor pressures of the $RbF\text{-}ZrF_4$ and $LiF\text{-}ZrF_4$ systems were measured over the ranges of 690-1060 C and 670-1060 C, respectively. On the basis of previously developed theory, it was concluded that the complexes $RbZr_2F_9$ and $LiZr_2F_9$ exist in the vapor phase of the respective systems. Plots showing the change of total pressure with composition for various temperatures, as well as melting point curves, are given for the various systems.

Controlled-Atmosphere Arc Welding. N. E. Weare and R. E. Monroe. *Welding Journal*, v. 37, December, 1958, pp. 1169-1175.

Some of the general considerations of controlled-atmosphere arc welding, shielding systems open to the atmosphere, and systems closed to the atmosphere are discussed.

Members of the Battelle staff are authors of the recently published articles and books listed on these pages. In most cases, reprints are available from the Battelle Publications Office, 505 King Avenue, Columbus 1, Ohio.

BATTELLE TECHNICAL REVIEW

ABSTRACTS

Volume 8, Number 3

March 1959

Aeronautical Engineering 121a
Agriculture 122a
Biochemistry and Biophysics 122a
Ceramics and Concrete 125a
Chemical Engineering 127a
Chemistry—Analytical 128a
Chemistry—Inorganic and General 129a
Chemistry—Organic 130a
Chemistry—Physical 133a
Coatings 137a
Control Systems, Computers, and Systems Engineering 138a
Electrical Engineering 138a
Electrochemistry 139a
Electronics 139a
Engineering Economics 142a
Fluid Mechanics 142a
Food Technology 143a
Fuels and Combustion 144a
Geology, Geophysics, Mineralogy and Mining Engineering 145a
Graphic Arts 146a
Heat Power 147a
Information—Preparation and Dissemination 147a
Instrumentation 147a
Lubrication and Friction 148a
Mechanical Engineering 148a
Metallurgy 150a
Metals—Corrosion 151a
Metals—Extraction and Refining 152a
Metals—Finishing, Polishing, and Cleaning 153a
Metals—Foundry Practice 153a
Metals—Heat Treatment 155a
Metals—Mechanical and Physical Properties 155a
Metals—Mechanical Working 158a
Metals—Metallography, Transformations, and Structures 161a
Metals—Powder 164a
Nondestructive Testing and Quality Control . . . 164a
Nuclear Physics, Nucleonics, and Radiation 165a
Operations Research and Management Engineering . 170a
Ore and Materials Beneficiation 170a
Physics 171a
Plastics 177a
Pollution and Wastes 179a
Rubber and Elastomers 179a
Space Heating and Conditioning 180a
Textiles, Fibers, Leather, and Paper 180a
Welding and Joining 181a
Miscellaneous 182a

AERONAUTICAL ENGINEERING

2449* Sonic Limit Singularities. I. General Theory. II. Examples. ***G. S. S. Ludford and S. H. Schot.*** *Archive for Rational Mechanics and Analysis*, v. 2, no. 2, Oct. 31, 1958, p. 160-190.

2450 Interplanetary Probes: Three Problems. Limited opportunities for launching vehicles to Mars and Venus with the present state of the art, flight path errors, and midcourse guidance requirements point up the difficulties involved in such missions. ***Krafft Ehricke.*** *Astronautics*, v. 4, Jan. 1959, p. 20 + 5 pages.

2451 An Introduction to Space Navigation. At present, celestial navigation appears to be a good candidate for the difficult job of guiding vehicles in interplanetary space. ***Manuel Fernandez.*** *Astronautics*, v. 4, Jan. 1959, p. 23 + 3 pages.

2452* Aeroballistics Range Measurements of the Performance and Stability of Supersonic Aircraft. Describes a method of measuring aircraft drag and stability characteristics in free flight. Tests were made firing scale models of existing delta- and straight-winged aircraft into an aeroballistics range at supersonic speed and high Reynolds number. Histories of the model's speed, attitude angles and lateral motion during the flight are obtained using light screens and yaw cards, while shock wave and flow behavior are observed with schlieren systems. ***H. R. Warren, R. J. Templin, and B. Cheers.*** *Canadian Aeronautical Journal*, v. 4, no. 10, Dec. 1958, p. 351-361.

2453 Conquest of Space and Time. The Air. A popular historical accounting of aircraft and man's exploration of the atmosphere from the first balloon flights to the present day. ***Edgar B. Schieldrop.*** 256 pp. 1958. Philosophical Library, New York. (TL515 Sch32a)

2454 Final Performance Testing of a Large Guided Missile. Describes test equipment, facilities, and general procedures used in systems checkout and final simulated flight test for the Jupiter missile. ***Robert L. Smith, Jr.*** *Electrical Manufacturing*, v. 62, Dec. 1958, p. 46-52.

2455* Canadair CL-44. Design and construction of the basic aircraft and the interior layout. *Flight*, v. 74, Dec. 12, 1958, p. 913-916.

2456 Oblateness Correction to Impact Points of Ballistic Rockets. A method is developed for finding the effect of the Earth's oblateness on the impact points of ballistic rockets. Suitable descriptive variables are chosen so that the oblateness perturbations can be obtained by quadrature, and explicit results are obtained correct to first order in an oblateness parameter; specifically, changes in range angle, a lateral displacement angle, and time of flight. The short range limiting forms of the corrections are obtained and interpreted, and an illustrative numerical example is given for a long range trajectory. ***Robert E. Roberson.*** *Franklin Institute, Journal*, v. 266, no. 6, Dec. 1958, p. 465-482.

2457 Approximate Three-Dimensional Solutions for Transient Temperature Distribution in Shells of Revolution. An approximate three-dimensional heat conduction equation is formulated for thin shells of revolution by making assumptions similar to those of the theory of thin elastic shells. It is then shown that the resulting partial differential equation is separable for all shell shapes and that solutions may be obtained in terms of well-known functions. It is also possible, for a broad class of problems, to express solutions as combinations of a one-dimensional slab solution and suitably defined correction functions. ***Maurice A. Brull and Jack R. Vinson.*** *Journal of the Aero/Space Sciences*, v. 25, Dec. 1958, p. 742-750.

2458 Theoretical Investigation of the Flow Field About Blunt-Nosed Bodies in Supersonic Flight. A numerical method for obtaining the solution to the inverse problem of the flow behind a given detached shock to any desired accuracy is presented. The cases of zero and small incidence are considered. The combination of sets of such solutions satisfying prescribed boundary conditions (body shapes) is described. Particular attention is devoted to the analysis of the sonic and subsonic

region of the flow field. Convergence and stability of the stepwise integration from the shock in the elliptic region are discussed. ***Roberto Vaglio-Laurin and Antonio Ferri.*** *Journal of the Aero/Space Sciences*, v. 25, Dec. 1958, p. 761-770.

2459 A Geometric Problem Related to the Optimum Distribution of Lift on a Planar Wing in Supersonic Flow. The problem studied may be regarded as a problem of geometry. Its simplest form (loosely stated) is then as follows: A mountain rises up from the x-y plane. Determine the exact shape of the mountain knowing only the cross-sectional area of every possible cut which can be made through the mountain with a vertical plane. In a more complicated version of the problem, the given information might be restricted to the cross-sectional area of every cut which can be made by a vertical plane inclined less than 45° to the y-axis. ***E. W. Graham.*** *Journal of the Aero/Space Sciences*, v. 25, Dec. 1958, p. 771-774.

2460 On the Excitation of Pure Natural Modes in Aircraft Resonance Testing. A method is proposed for systematic adjustment of force levels to produce a pure undamped natural mode of vibration in multipoint excitation of aircraft structures. The question of optimum numbers of measuring stations and exciters is examined and some conclusions are reached. ***R. W. Traill-Nash.*** *Journal of the Aero/Space Sciences*, v. 25, Dec. 1958, p. 775-778.

2461 Radiation Can Be Avoided. Advocates polar launchings; proposes that two radiation belts be mapped by 100-pound payload satellite. ***Norman L. Baker.*** *Missiles and Rockets*, v. 5, no. 1, Jan. 5, 1959, p. 13-14.

2462 Progress of the Russian Earth Satellite Sputnik 3 (1958). Orbital data and probable fate. ***D. G. King-Hele.*** *Nature*, v. 182, Nov. 22, 1958, p. 1409-1411.

2463 Russians Review Aircraft-Reactor-Performance Goals. Review of "Application of Atomic Engines in Aviation", which appeared in Military Press of the Ministry of Defense of the USSR, Moscow, 1957. *Nucleonics*, v. 17, Jan. 1959, p. 84.

2464* A New Approach to the Theory of a Slender Body in Compressible Flow. Demonstrates that the equation of perturbation given to a known two-dimensional or axisymmetric flow of compressible fluid can be written in a simple form by choosing appropriate coordinates. ***Haruo Moriguchi.*** *Physical Society of Japan, Journal*, v. 13, Nov. 1958, p. 1384-1390.

See also: **2934** (earth satellite orbit anomaly); **3321** (quality control in airline maintenance); **3128** (airframe die castings).

AGRICULTURE

2465* Some Physiological Peculiarities of the Sunflower as an Oil Plant. Maximum aldolase activity coincides with an intense consumption of the carbohydrates previously accumulated in the seed. Correlation between lipase activity and lipogenesis suggests that in the starch grains and the plastids, lipogenesis occurs at the expense of starch. ***A. A. Prokofiev.*** *Agrochimica*, v. 2, no. 4, Sept. 1958, p. 334-349 + 3 plates.

2466* Characterization of Polysaccharides Isolated From Forest Soils. Polysaccharides isolated from the upper mineral horizons beneath mor are smaller in both amount and size than the polysaccharides from mull. Polysaccharides isolated from a well-aggregated mull soil are much more active in aggregating soil particles of a non-aggregated soil than are the polysaccharides isolated from mor. ***B. Bernier.*** *Biochemical Journal*, v. 70, no. 4, Dec. 1958, p. 590-599.

2467 A Chemically Defined Diet and Axenic Rearing Method for Larvae of the Seed-Corn Maggot, *Hylemya cilicrura* (Rond.) (Diptera:Anthomyiidae). The diets consisted of 19 *l*-amino acids, 9 water-soluble vitamins, coenzyme A, inosine, thymine, ribonucleic acid, glucose, a salt mixture, water, and agar. They contained no plant extracts or unknown growth factors. ***W. G. Friend, E. H. Salkeld, and R. J. McClanahan.*** *Canadian Journal of Zoology*, v. 36, no. 6, Dec. 1958, p. 931-936.

2468* Reproduction in DDT- and Diazinon-Treated House Flies. The effects of sublethal doses were compared on a DDT-resistant and a susceptible laboratory strain of the house fly. ***Preston E. Hunter, L. K. Cutkomp, and A. M. Kolkaila.*** *Journal of Economic Entomology*, v. 51, no. 5, Oct. 1958, p. 579-582.

2469* Natural Enemies of the Spotted Alfalfa Aphid in Utah. ***Karim Goodarzy and Donald W. Davis.*** *Journal of Economic Entomology*, v. 51, no. 5, Oct. 1958, p. 612-616.

2470* Resistance of House Flies in Florida to Organophosphorus Insecticides. Based on the LC-50's in tests with contact sprays, 14 strains of house flies in 1957 were 3 to 133 times as resistant as normal flies to malathion, 11 of the strains were 1.3 to 72 times as resistant to Dipterex, five strains were 5 to 38 times as resistant to Diazinon, and seven were 3 to $>$ 18 times as resistant to parathion as normal flies. ***G. C. LaBrecque, H. G. Wilson, and J. B. Gahan.*** *Journal of Economic Entomology*, v. 51, no. 5, Oct. 1958, p. 616-617.

2471* Control of the Cabbage Looper With a Virus Disease. Laboratory and field experiments showed that the virus which causes polyhedrosis of the cabbage looper is a highly virulent pathogen and that the viral contents of two diseased larvae applied per acre as a spray may be adequate for satisfactory control. ***F. L. McEwen and G. E. R. Hervey.*** *Journal of Economic Entomology*, v. 51, no. 5, Oct. 1958, p. 626-631.

2472* Acid Hydrolysis and Molecular Weights of Various Corn Amylopectin and Glycogen. Amylopectin samples were obtained from mature and immature sweet, dent, and waxy varieties of corn starch samples. The degree of branching, molecular weights, and radii of gyration were obtained on these amylopectins. A comparison of the properties of a sweet corn glycogen sample and an immature sweet corn amylopectin sample indicates that glycogen is a precursor to starch. ***Stig R. Erlander and Dexter French.*** *Journal of Polymer Science*, v. 32, Nov. 1958, p. 291-316.

2473 An Artificial Diet for the Laboratory Rearing of Locusts. ***G. F. Howden and P. Hunter-Jones.*** *Nature*, v. 182, Nov. 29, 1958, p. 1527-1528.

2474 A New Type of Insecticide. Strains of *D. melanogaster* characterized by resistance to DDT, BHC, parathion and other insecticides were susceptible to phenylthiourea, while the majority of strains susceptible to DDT were resistant to phenylthiourea. ***Zenichi Ogita.*** *Nature*, v. 182, Nov. 29, 1958, p. 1529-1530.

2475* Auxin Activitiy of Some Indole Derivatives. The activities of 20 indole derivatives and four related compounds have been determined in three bioassays. ***Kenneth V. Thimann.*** *Plant Physiology*, v. 33, no. 5, Sept. 1958, p. 311-321.

2476 Ancestor of Corn. ***Paul C. Mangelsdorf.*** *Science*, v. 128, Nov. 28, 1958, p. 1313-1320.

See also: **3607** (chemically enriched sawdust composts).

BIOCHEMISTRY AND BIOPHYSICS

2477* The Cytotoxic Action of Normal Human Serum on Certain Human Cells Propagated *in Vitro*. Normal human serum was rapidly lethal to two permanent lines of atypical human cells propagated in medium containing horse serum while having no effect on relatively normal short-term cultures of human fibroblasts. Horse, guinea pig, rat, and rabbit sera showed no toxic effect on these cells under the same experimental conditions. ***Robert P. Bolande and Earl W. Todd.*** *AMA Archives of Pathology*, v. 66, Dec. 1958, p. 720-732.

2478* Formation of Particulate Ribonucleoprotein With Enzymatic Activities *in vitro*. The results indicate that particulate ribonucleoproteins isolated from bacterial cells may not necessarily represent original particles of the cell. Particles may be formed in a haphazard manner during extraction and purification. ***Agnar P. Nygaard.*** *Acta Chemica Scandinavica*, v. 12, no. 8, 1958, p. 1697.

2479* Effect of Ionizing Radiation Upon the Chemical Composition of Mitochondria. Evaluation of the content of nucleic acids and phospholipides of irradiated potato tubers. The changes in activity of the acidifying enzymes under the effect of radiation must be related to the disturbance of the structural integrity and of the chemical composition of mitochrondria. (*In Russian.*) Vliianie ioniziruiushcheĭ radiatsii na khimicheskiĭ sostav mitokhondriĭ. ***B. A. Rubin and A. V. Mikheeva.*** *Akademiia Nauk SSSR, Doklady*, v. 122, no. 5, Oct. 11, 1958, p. 867-869.

2480 Smoking and Death Rates—A Riddle in Cause and Effect. A prospective study of the smoking habits and mortality of nearly 190,000 men between the ages of 50 and 69 in good health at the start of the study. ***E. Cuyler Hammond.*** *American Scientist*, v. 46, no. 4, Dec. 1958, p. 331-354.

2481* Staphylococcal Resistance to Ristocetin, Oleandomycin, and Novobiocin. Fivefold increase of resistance to ristocetin in staphylococci required 10 steps by the agar plate technique; approximately eleven hundred fold increase of resistance to novobiocin, five steps; one thousand fold increase of resistance to oleandomycin, three steps or more. No significant cross resistance of novobiocin- and oleandomycin-resistant strains with penicillin, erythromycin, carbomycin, the tetracyclines, and chloramphenicol was found, and vice versa. ***Jen-Yah Hsie, et al.*** *Antibiotics & Chemotherapy*, v. 8, Dec. 1958, p. 607-614.

2482* Cross-Resistance Studies and Antibiotic Identification. Methods are described for production, maintenance, and use of antibiotic resistant cultures and a study of the interrelationships of a number of known antibiotics with these resistant strains has been reported. ***E. O. Stapley.*** *Applied Microbiology*, v. 6, no. 6, Nov. 1958, p. 392-398.

2483* Isolation and Structure of a Melanocyte-Stimulating Hormone From Pig Pituitary Glands. The hormone is composed of 18 amino acid residues. The amino acid sequence of β-MSH contains a sequence of seven amino acids, which also occurs in the corticotropins. This observation and the intrinsic melanocyte-stimulating activity of the corticotropins suggest a possible chemical basis for the action of the hormone. ***Paul Roos.*** *Arkiv för Kemi*, v. 13, no. 3, 1958, p. 217-224.

2484 Space Biology. II. Much Study Must Precede Man in Space. A paper presented recently before a meeting of NATO's Advisory Group for Aeronautical Research and Development in Copenhagen, Denmark by Brig. Gen. Don Flickinger outlining his views on the biomedical aspects of space flight. ***Don Flickinger.*** *Aviation Week*, v. 69, Dec. 29, 1958, p. 38-41.

2485* The Occurrence and Distribution of Thymine and Three Methylated-Adenine Bases in Ribonucleic Acids From Several Sources. Although all four methylated bases were detected in the ribonucleic acid from most of the microorganisms examined, thymine and 2-methyl-adenine were not found in liver ribonucleic acid and all these bases appeared to be absent from the ribonucleic acid of two plant viruses. ***J. W. Littlefield and D. B. Dunn.*** *Biochemical Journal*, v. 70, no. 4, Dec. 1958, p. 642-651.

2486 Biochemical Preparations. Presents carefully checked procedures for preparing reasonable quantities of materials not readily obtainable. ***Carl S. Vestling.*** v. VI. 105 pp. 1958. John Wiley & Sons, New York. (QP509 B52p Vis.)

2487* Inhibition of Orotidylic Acid Decarboxylase, a Primary Site of Carcinostasis by 6-Azauracil. It has been demonstrated that in cultures of *Escherichia coli* inhibited by 6-azauracil, large amounts of orotic acid and orotidylic acid (OMP) accumulate. These experimental data indicate that these antimetabolites interfere with the synthesis *de novo* of pyrimidine nucleotides by inhibition of OMP decarboxylase. *Biochimica et Biophysica Acta*, v. 30, no. 2, Nov. 1958, p. 451-452.

2488* Structure and Properties of Microsomal Nucleoprotein Particles From Pea Seedlings. Presents data on magnesium and calcium ion content of the particles, on the sites of binding of these ions, and describes methods for reversible precipitation of the particles. Some deductions regarding the structure of the particles are presented. ***Paul O. P. Ts'O, James Bonner, and Jerome Vinograd.*** *Biochimica et Biophysica Acta*, v. 30, no. 3, Dec. 1958, p. 570-582.

2489* A Radiation-Sensitive Mutant of *Escherichia coli*. *Biochimica et Biophysica Acta*, v. 30, no. 3, Dec. 1958, p. 636-637.

2490* Action of Tobacco-Leaf Ribonuclease on Polyuridylic and Cytidylic Acids. The rate of hydrolysis of poly C was much less than that of poly U. After incubation for 7 h, poly U was completely hydrolyzed while only 66% of poly C appeared as cytidine-2',3'-cyclic phosphate. ***K. K. Reddi.*** *Biochimica et Biophysica Acta*, v. 30, no. 3, Dec. 1958, p. 638.

2491* Electron Microscope Study of DNA-Containing Plasms. II. Vegetative and Mature Phage DNA as Compared With Normal Bacterial Nucleoids in Different Physiological States. Nucleoids of *Escherichia coli*, independently of the physiological state of the bacteria, are shown to be preserved as a fine-stranded fibrillar nucleoplasm by an OsO_4 fixation under certain defined conditions. The same fixation procedure applied to the DNA of vegetative phage reveals a pool of homogeneous fibrillar structure very similar to the nucleoplasm. Authors postulate that the genetic material of bacteria may multiply following the same mechanism as phage. The nucleoid would be simply a pool containing one or several bacterial genomes in a form similar to vegetative phage. ***Edouard Kellenberger, Antoinette Ryter, and Janine Séchaud.*** *Journal of Biophysical and Biochemical Cytology*, v. 4, no. 6, Nov. 25, 1958, p. 671-676 + 5 plates.

2492* Specific Reactions of Polyelectrolytes With the Surfaces of Normal and Tumour Cells. Polyethylene imine has been found to show some specificity towards tumor cells. ***E. J. Ambrose, D. M. Easty, and P. C. T. Jones.*** *British Journal of Cancer*, v. 12, no. 3, Sept. 1958, p. 439-447.

2493* A New Approach to the Mechanism of Carcinogenesis. Carcinogenesis is discussed in relation to electron transfer processes in carcinogen-protein complexes. ***R. Mason.*** *British Journal of Cancer*, v. 12, no. 3, Sept. 1958, p. 469-479.

2494* A Toxin-Inactivating Substance (Noxiversin) From *Penicillium cyaneo-fulvum* (Biourge). Noxiversin is distinct and separate from an antibiotic produced by the same mold and may be concentrated by fractional precipitation. The albumen fraction of culture filtrates includes all the toxin-neutralizing activity. ***E. G. D. Murray, G. D. Denton, J. W. Stevenson, and B. B. Diena.*** *Canadian Journal of Microbiology*, v. 4, no. 6, Dec. 1958, p. 593-609.

2495* Immunochemical Studies of Organ and Tumor Lipids. V. Lipid Haptens of a Human Epidermoid Carcinoma Grown in Rats. ***Maurice M. Rapport, Liselotte Graf, and Nicholas F. Alonzo.*** *Cancer*, v. 11, no. 6, Nov.-Dec. 1958, p. 1136-1139.

2496* The Control of Cell Division: A Review. II. Special Mechanisms. ***M. M. Swann.*** *Cancer Research*, v. 18, no. 10, Nov. 1958, p. 1118-1160.

2497* Some Aspects of the Ascites Tumor Cell Response to a Heterologous Antiserum. The effects of antiserum and complement on the volume and permeability of the Ehrlich ascites tumor were studied. The cells quickly underwent marked swelling concomitant with an increased permeability to inorganic phosphate. Following this there was a loss of acid-soluble organic phosphorus from the cells to the suspending medium. Dilution of either antiserum or complement led to a diminution of all these effects. Both components were necessary. ***K. A. O. Ellem.*** *Cancer Research*, v. 18, no. 10, Nov. 1958, p. 1179-1185.

2498* Metabolic Effects of 6-Thioguanine. I. Studies on Thioguanine-Resistant and -Sensitive Ehrlich Ascites Cells. A subline of the Ehrlich ascites carcinoma exhibiting resistance to thioguanine was developed by consecutive passage of cells

in mice treated with doses of 6-thioguanine. The change was found to be stable and heritable. The thioguanine-resistant population was slightly more susceptible to combination therapy of azaserine plus thioguanine than the parent thioguanine-sensitive tumor. Azaserine pretreatment not only increased the quantity of thioguanine nucleotides formed but also increased the quantity of thioguanine found in the nucleic acid fraction of the resistant Ehrlich ascites cells. These effects appear to explain in part the sensitivity of thioguanine-resistant cells to combination therapy with azaserine and thioguanine. The presence of more active degradative enzymes for thioguanine appeared to be the biochemical basis for resistance to this drug in the thioguanine-resistant subline of the Ehrlich carcinoma. ***Alan C. Sartorelli, G. A. LePage, and E. C. Moore.*** *Cancer Research*, v. 18, no. 10, Nov. 1958, p. 1232-1239.

2499 Blood Pressure and Heart Rate Regulator. Electronic control of dog's heart in laboratory experiments. ***Robert L. Skinner, Dietrich K. Gehmlich, and Frank W. Longson.*** *Electronics*, v. 32, no. 1, Jan. 2, 1959, p. 38-41.

2500* Two Chemicals Promoting Cell Division in the Yoshida Sarcoma Cells. Two chemicals were found by the writer to act as mitotic stimulants on animal cells. One is kinetin and the other is Na-glucuronate. ***Y. Ogawa.*** *Experimental Cell Research*, v. 15, no. 2, Oct. 1958, p. 415-418.

2501* Aminopterin and Nitrogen Mustard as Mitotic Inhibitors in Mouse Ear Epidermis *in Vitro*. Demonstrates that both Aminopterin and nitrogen mustard are dissimilar to colchicine in that they do not inhibit mitosis in metaphase. These results differ from those obtained by Hughes and Jacobsson with embryonic chick tissue culture. ***S. Gelfant.*** *Experimental Cell Research*, v. 15, no. 2, Oct. 1958, p. 451-453.

2502 Study of the Electronic Structure of Cancerogenic Aromatic Amines. I. β-Naphthylamine. Calculation of static and dynamic indexes of the β-naphthylamine molecule. Chemical reactivity. Formation of complexes with the acceptor cellular elements. (*In French.*) Recherches sur la structure électronique des amines aromatiques cancérogènes. I. La β-naphtylamine. ***Ginette Tarrago and M. Bernard Pullman.*** *Journal de Chimie Physique*, v. 55, Oct. 1958, p. 782-789.

2503* The Iron Content of Tobacco Mosaic Virus and Some Properties of Its Infectious Nucleic Acid. The iron content of two types has been established as 1.5 mg. per 100 gm. ***Hubert S. Loring, Saad Al-Rawi, and Yasuo Fujimoto.*** *Journal of Biological Chemistry*, v. 233, no. 6, Dec. 1958, p. 1415-1420.

2504* Abnormal Human Serum Globulins. II. Physical Constants and Amino End Groups. ***Frank W. Putnam.*** *Journal of Biological Chemistry*, v. 233, no. 6, Dec. 1958, p. 1448-1454.

2505* Aspects of the Stability of a Bacterial Ribonucleic Acid. In contrast to RNA formed during normal growth, the ribonucleic acids formed after the inhibition of protein synthesis by chloramphenicol exhibit a marked instability *in vivo*. ***Jack Horowitz, Anna Lombard, and Erwin Chargaff.*** *Journal of Biological Chemistry*, v. 233, no. 6, Dec. 1958, p. 1517-1522.

2506* Genetics of Somatic Mammalian Cells. III. Long-Term Cultivation of Euploid Cells From Human and Animal Subjects. A methodology designed to eliminate mitotic inhibitor action and involving use of pretested fetal calf serum and careful pH and temperature control is described by which cells from normal human and animal tissue can be maintained in active growth for long periods *in vitro* without development of aneuploidy. By means of this procedure, it is possible reliably to establish stable cell cultures from minute skin biopsies which can be taken from any individual. Applications of these techniques to chromosome delineation in large numbers of human subjects; determination of chromosomal sex in patients; spontaneous and induced genetic changes in somatic mammalian cells *in vivo* and *in vitro;* comparison of metabolic differences between normal and cancerous cells, and other problems have been indicated. ***Theodore T. Puck, Steven J. Cieciura, and Arthur Robinson.*** *Journal of Experimental Medicine*, v. 108, Dec. 1958, p. 945-955 + 2 plates.

2507* *In Vitro* Production of Diphtheria Antitoxin by Tissues of Immunized Animals. II. Development of a Synthetic Medium Which Promotes Antibody Synthesis and the Incorporation of Radioactive Amino Acids Into Antibody. Addition to various basal synthetic media of dialyzed or undialyzed homologous or heterologous serum did not consistently enhance *in vitro* antibody synthesis by lymphoid tissues from immunized rabbits. Optimal concentrations of certain amino acids must be present in the medium for maximal *in vitro* antibody synthesis and incorporation of radioactive amino acids into antibody, emphasizing the importance of amino acids as precursors of antibodies. A completely synthetic medium has been developed which promotes appreciable antibody synthesis and incorporation of radioactive amino acids into antibody. ***Benjamin Wolf and Abram B. Stavitsky.*** *Journal of Immunology*, v. 81, no. 5, Nov. 1958, p. 404-413.

2508* Immunochemical Studies of Poliovirus. III. Further Studies on the Immunologic and Physical Properties of Poliovirus Particles Produced in Tissue Culture. Evidence was obtained for the existence of four distinct viral particles. ***Bernard Roizman, Manfred M. Mayer, and Herbert J. Rapp.*** *Journal of Immunology*, v. 81, no. 5, Nov. 1958, p. 419-425.

2509 Intraduodenal Administration of Indigenous Drugs. Drugs which are absorbed from the duodenum give a prompt response, and when crude extracts of the drugs are given, there are fewer side effects due to the solvent. This mode of drug administration may be useful in screening crude extracts of medicinal plants. ***Roger A. Lewis and J. D. Kohli.*** *Journal of Scientific & Industrial Research*, v. 17B, Oct. 1958, p. 168-172.

2510 Plasma Cells and Tumour Growth. Suggests that the increased response of plasma cells is the morphological manifestation of a systemic immune reaction to circulating antigen(s), which leave the graft, and reach the regional lymph nodes and spleen, and that plasma cells are involved in the production of antibodies. Transplantation immunity to tumor and normal tissues conforms with the immune state generated by bacterial and other foreign protein antigens. ***B. D. Baruah.*** *Nature*, v. 182, Nov. 22, 1958, p. 1455-1456.

2511 Space Medicine. A synopsis of papers presented at the symposium on space medicine sponsored by the British Interplanetary Society in London, October, 1958. Major topics discussed included: weightlessness, acceleration, space cabin environment, heat exchange between man and his space environment, and radiation hazards. ***J. Billingham.*** *Nature*, v. 182, Dec. 13, 1958, p. 1645-1646.

2512 Chemical Pathology of the Nervous System. Reviews the program of the third International Neurochemical Symposium held in the University of Strasbourg, August, 1958. The general subject of the meeting was chemical pathology of the nervous system and included papers on the following subjects: brain gangliosides and sulfatides, copper protein of brain tissue, demyelination, protein synthesis in the nerve cell, chemistry of convulsive states, enzyme distribution in the isocortex, hormones in mental disease, and metabolism of amines, including 5-hydroxytryptamine. ***G. B. Ansell.*** *Nature*, v. 182, Dec. 13, 1958, p. 1646-1648.

2513 Effect of Adrenaline on Neurofibril Formation in Adult Mammalian Cortical Neurones in Tissue Culture. ***R. S. Geiger.*** *Nature*, v. 182, Dec. 13, 1958, p. 1674-1675.

2514 Effect of Viral Infection and Cortisone Upon Tumour Growth in Homologous and Heterologous Hosts. In contrast with grafts in heterologous hosts (rats), the growth of the primary tumor in mice was suppressed by cortisone treatment. Moreover, in mice treated with cortisone, metastases were quite often found in lung and kidney. Col.-SK virus was injected into tumors in such mice and the *LD*50's of sarcomas in cortisone-treated and non-treated mice were compared. There were no significant differences in the virus titers. Therefore, differences in the virus titers between sarcomas grown in cortisone-treated rats and non-treated mice may not be due to the influences of cortisone but to the effects of the host animal. ***T. Kuwata, Y. Yasumura, and M. Kanisawa.*** *Nature*, v. 182, Dec. 13, 1958, p. 1678-1679.

2515* Some Causes Underlying Cellular Differentiation. ***Richard A. Popham.*** *Ohio Journal of Science*, v. 58, no. 6, Nov. 1958, p. 347-353.

2516 Progress in the Chemistry of Organic Natural Products. Catechin, aconite-garrya alkaloids, structural chemistry of actinomycetes antibiotics, protein synthesis in plants, and theory of the color of natural and artificial dyes. ***L. Zechmeister, editor.*** v. XVI. 226 pp. 1958. Springer-Verlag, Vienna, Austria. (QD245 F77c Vis.)

2517* Protection Provided by Added Substances Against the Direct Action of Ionizing Radiations. Degradation of solid polymethyl methacrylate by ionizing radiations can be reduced by the addition of low-molecular-weight substances to the polymer. Protection is the result of a transfer process by which the energy deposited in the polymer is diverted to the protective agent in the interval between the occurrence of ionization and the appearance of the final radiation-chemical change. The fact that so many substances having quite diverse chemical properties can protect supports the energy-transfer mechanism rather than one involving repair of the damaged polymer molecule. ***P. Alexander and D. J. Toms.*** *Radiation Research*, v. 9, no. 5, Nov. 1958, p. 509-524.

2518 Hazard to Man of Carbon-14. The transmutation effect of carbon-14 atoms contained in the genetic material of the human body could lead to about the same number of genetic mutations as the radiation effect from carbon-14. ***John R. Totter, M. R. Zelle, and H. Hollister.*** *Science*, v. 128, Dec. 12, 1958, p. 1490-1495.

2519 Fifty Years of Medical Genetics. Reviews the general mode of control exerted by genes on metabolism and cites examples illustrating a variety of enzyme defects related to specific diseases. ***Laurence H. Snyder.*** *Science*, v. 129, Jan. 2, 1959, p. 7-13.

2520 Nonidentity of Fetuin and Protein Growth (Flattening) Factor. Highly purified fetuin from fetal calf serum did not exhibit protein growth factor activity. ***Irving Lieberman, Francois Lamy, and Peter Ove.*** *Science*, v. 129, Jan. 2, 1959, p. 43-44.

2521 Sterility in Female Guinea Pigs Induced by Injection With Testis. Adult virgin female guinea pigs were injected with an emulsion of homologous adult testis and Freund's adjuvant before exposure to males. The fertility of this group was only 24% while the fertility of the control group was 84%. ***Shinzo Isojima, Ruth M. Graham, and John B. Graham.*** *Science*, v. 129, Jan. 2, 1959, p. 44.

2522* Antimitotic Action of Maleuric Acid. Maleuric acid produced mitotic inhibition in onion root-tip cells and an increase in proportion of mitotic cells in metaphase, but little or no cytoplasmic or nuclear abnormality was observed. A single intraperitoneal injection of maleuric acid into mice bearing the Ehrlich ascites tumor resulted in marked cytoplasmic blebbing of the tumor cells. Mitotic abnormalities produced by the treatment persisted for prolonged periods. The affected tumor cells showed essentially normal patterns of free amino acids. ***Tadashi Okada and Eugene Roberts.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 99, no. 2, Nov. 1958, p. 329-332.

2523* Methods of Harvesting Mammalian Cells Grown in Tissue Culture. HeLa cells and chick embryo fibroblasts were grown on glass and harvested under various conditions. Trypsinization and scraping were each compared with alcohol-ether denaturation. Trypsinization was found to be less efficient as a means of obtaining material for chemical analysis although less damaging to cell viability than scraping. Alcohol-ether denaturation *in situ* was the preferred means of harvesting cells for chemical analysis. ***W. E. Magee, M. R. Sheek, and B. P. Sagik.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 99, no. 2, Nov. 1958, p. 390-392.

2524* Transformation of Steroids by Pseudomonas. ***Hayao Nawa, et al.*** *Tetrahedron*, v. 4, nos. 1/2, Oct. 1958, p. 201-202.

2525* Absorption and Translocation of Mammalian Viruses by Plants. I. Survival of Mouse Encephalomyelitis and Poliomyelitis Viruses in Soil and Plant Root Environment. Mouse encephalomyelitis virus, strain FA, survived 3-4 weeks in soil, in liquid suspension from 7 to 12 days. Soil pH influenced survival of GD VII virus which persisted for 3-4 weeks in alkaline soil, at least 5 weeks in neutral soil, but could not be recovered from acid soil after incubation for 24 hours. Type 1 poliovirus was recoverable from sterile soil for 6-7 weeks, and from nonsterile soil for 2-3 weeks. Soil and soil clays adsorbed and held firmly large quantities of poliovirus. ***William H. Murphy, Jr., Ollie R. Eylar, Edwin L. Schmidt, and Jerome T. Syverton.*** *Virology*, v. 6, no. 3, Dec. 1958, p. 612-622.

2526* The Irradiation of Phage-Infected Bacteria: Its Bearing on the Relationship Between Functional and Genetic Radiation Damage. The radiations employed were ultraviolet light (with and without photoreactivation), soft X-rays, and P^{32} decay. The only occasion in which any increase in radiation resistance was found during this period was when T2-infected bacteria were irradiated with ultraviolet light and their resistance measured before photo-reactivation had been carried out. ***N. Symonds and Elinor W. McCloy.*** *Virology*, v. 6, no. 3, Dec. 1958, p. 649-668.

2527* The Introduction of Tobacco Mosaic Virus Into Single Hair Cells of *Nicotiana langsdorffii* Leaves. II. The Effect of Ribonuclease. Pancreatic ribonuclease inhibited lesion formation if introduced into the inoculated cell before or shortly after the virus, and when introduced in a mixture of virus and inhibitor. The enzyme also prevented lesion formation when introduced into a cell through which the virus must pass to reach the leaf from the inoculated cell. ***G. T. A. Benda.*** *Virology*, v. 6, no. 3, Dec. 1958, p. 718-724.

2528* Mathematical Analysis of Radiation Inactivation of Microbiological Objects of Different Degrees of Ploidy Considering Genetic and Nongenetic Components. Criticizes the multi-target model which assumes that only recessive lethal mutations are responsible for the effect. Proposals are made for the use of a more complete and less specialized formula. The observed crossing of dose-effect-curves of haploid and diploid yeast strains can be explained by this mathematical theory. The importance of the use of endomitotically originated strains of different ploidy and complete homozygous constitution is emphasized. Such strains are available in *Saccharomyces*. (*In German.*) Zur mathematischen Analyse der Strahleninaktivierung mikrobiologischer Objekte verschiedenen Ploidiegrades unter Berücksichtigung genetischer und nichtgenetischer Anteile. ***Werner Stein and Wolfgang Laskowski.*** *Zeitschrift für Naturforschung*, v. 13b, Oct. 1958, p. 651-657.

CERAMICS AND CONCRETE

2529* Setting and Hardening of Hydraulic Materials. I. The Setting and Hardening of Plaster of Paris. II. Conductometric Analysis of Setting of Cement Pastes Under Isothermic Conditions. ***I. Náray-Szabó and G. Szuk.*** *Acta Technica Academiae Scientiarum Hungaricae*, v. 22, nos. 1-2, 1958, p. 67-100.

2530 Immiscibility and Surface Tension of Some Simple Borates. Reports minimum concentrations of second cations that must be added to phase-separated binary borates to produce single-phase glasses. Surface tensions are also reported for melts at 900, 1000, 1100, 1200, and 1300 C. ***L. Shartsis, H. F. Shermer, and A. B. Bestul.*** *American Ceramic Society, Journal*, v. 41, Dec. 1958, p. 507-516.

2531 Influence of Reaction Products on Reaction Between Water and Soda-Lime-Silica Glass. Effects were studied by investigating the reactions of the glass with each individual reaction product. Mechanism of the reaction between the glass and water is suggested. ***Franklin Fu-Yen Wang and F. V. Tooley.*** *American Ceramic Society, Journal*, v. 41, Dec. 1958, p. 521-524.

2532 Effect of Composition of Kiln Atmosphere in the Firing of Refractory Oxides. Results show that alumina lost oxygen when heated at 1400 to 1500 C in water vapor but retained its weight unchanged when heated in air or in nitrogen and kiln gases dissolved in a mullitic material at temperatures between 800 and 1200 C. ***Folke Sandford and Erland Ericsson.*** *American Ceramic Society, Journal*, v. 41, Dec. 1958, p. 527-531.

2533 Phase Equilibria in the Alkali Fluoride-Uranium Tetrafluoride Fused Salt Systems. II. The Systems KF-UF_4 and RbF-UF_4. Detailed phase diagrams are presented. Data for the determination of phase boundaries were obtained in large part by quenching after equilibration. ***R. E. Thoma, Herbert Insley, B. S. Landau, H. A. Friedman, and W. R. Grimes.*** *American Ceramic Society, Journal,* v. 41, Dec. 1958, p. 538-544.

2534 Sintering Characteristics of Rare-Earth Oxides. Presents data on the density, grain size, thermal expansion, resistance to water corrosion, microhardness, and sinterability of europium, samarium, gadolinium, and dysprosium pure oxides at various temperatures under both oxidizing and reducing conditions as well as hot pressing. ***G. L. Ploetz, C. W. Krystyniak, and H. E. Dumas.*** *American Ceramic Society, Journal,* v. 41, Dec. 1958, p. 551-554.

2535* Some Problems of the Rheology of Concrete Mixtures. Investigation of concrete-mixture rheology from the viewpoint of its densification by vibration. Study of fluidity which is the most suitable technical criterion for characterization of a concrete mixture from the standpoint of its workability. Factors affecting fluidity of concrete: amount of specific fractions of fillers, the shape, the character of grain surface, amount and fineness of cement, amount of water and other additions; parameters of vibration, temperature of the concrete and the time interval between its preparation and use. Relationship between mixture fluidity and vibration densification. (*In Russian.*) Nekotorye voprosy reologii betonnoĭ smesi. ***A. A. Pavlik.*** *Beton i Zhelezobeton,* 1958, no. 10, Oct., p. 372-378.

2536* Study of Concrete Frost-Resistance Based on Change of Its Elastic and Plastic Characteristics. Determining strength of concrete by using its dynamic modulus of elasticity and logarithmic decrement of damping. Study of the relative change of strength, dynamic modulus of elasticity, and logarithmic decrement of damping for some specimens subjected to cyclic freezing and thawing. (*In Russian.*) Izuchenie morozostoĭkosti betonov po izmeneniiu ikh uprugikh i plasticheskikh kharakteristik. ***V. A. Latishenko.*** *Beton i Zhelezobeton,* 1958, no. 10, Oct., p. 393-395.

2537 Texture of Refractories. Comparisons of various methods for measuring dimensions and distribution of pores. ***L. Lécrivain.*** *British Ceramic Society, Transactions,* v. 57, Nov. 1958, p. 687-708.

2538 Dry Pan Investigations. II. Effect of Pan Speed and Feeding Arrangements on Output. The small-sample technique for investigating the operating of dry pans was applied to determine the effect of increasing the speed of revolution of the pan and the effect of modifications to the raw-material feeder. At one works an increase of at least 13% in output, without the fineness of the product being affected, was obtained by increasing the pan speed from 20 to 27 r.p.m. At another works, improvements in both output and size of material were obtained mainly by increasing the rate of feed of the raw material. A pan-output recorder, which eliminates much of the manual work from this type of investigation, is also described and results from its use are presented. ***R. Richards and A. Dinnie.*** *British Ceramic Society, Transactions,* v. 57, Nov. 1958, p. 709-733.

2539 The System $ZnO \cdot CdO \cdot B_2O_3$. Phase Relationships and Fluorescence. The subsolidus phase relationships were investigated using X-ray and petrographic methods. The fluorescence of $ZnO \cdot 2CdO \cdot 2B_2O_3$ was examined using Ag, Sn, Tl, Pb, and Sb as single activators as well as sensitizers with Mn. ***D. E. Harrison and F. A. Hummel.*** *Electrochemical Society, Journal,* v. 106, Jan. 1959, p. 24-26.

2540 How to Tool for Making Pressed Ceramic Parts. II. Die materials; pointers on design of dies and punches. ***George G. Karian.*** *Ceramic Industry,* v. 71, Dec. 1958, p. 86-89.

2541* The Determination of Boron in Glass Using Radium-Beryllium Neutron Source (Neutron Absorption Technique). Method for rapid assay of boron in samples containing other low cross-section elements. ***Yuzuru Kusaka.*** *Chemical Society of Japan, Bulletin,* v. 31, no. 8, Nov. 1958, p. 917-920.

2542 A Review of Container Glass Compositions. (1932-1957). Analytical data and measurements of physical properties; trends; influence of geographic location on compositions. ***W. R. Lester.*** *Glass Industry,* v. 39, Dec. 1958, p. 637 + 6 pages.

2543 Highlights of Scientific Glass Blowing. Historical account of glass blowing techniques. ***Vincent C. de Maria.*** *Glass Industry,* v. 39, Dec. 1958, p. 642 + 5 pages.

2544* Studies on Various Reactions in Ceramic Bodies During Firing. VII. On the Translucency of Bodies Consisting of Feldspar and Quartz. Four series of bodies were fired on various schedules. Translucency of the fired bodies was measured by means of a photocell. Relationships between translucency and microstructure were determined. (*In Japanese.*) ***Kenya Hamano.*** *Government Chemical Industrial Research Institute, Tokyo, Reports,* v. 53, Aug. 1958, p. 277-287.

2545 Steel Plant Refractories in Russia. Surveys results of attempts to improve quality and performance. ***Kenneth Shaw.*** *Iron & Steel,* v. 31, no. 13, Dec. 1958, p. 593.

2546* Notes on the Transformations of Tungsten Trioxide at About 300 C and Between 700 and 800 C. Close dilatometric study of the transformations of WO_3. Differential thermal analysis. Measurement of conductivity. Effect of these phenomena upon the actual oxidation velocity of tungsten. (*In French.*) Remarques sur les transformations présentées par l'anhydride tungstique vers 300°C et entre 700 et 800°C. ***Marc Foex.*** *Journal des Recherches du Centre National de la Recherche Scientifique,* no. 42, Mar. 1958, p. 1-8.

2547 Thermodynamic Study of SiC Utilizing a Mass Spectrometer. The sublimation of hexagonal SiC was studied under equilibrium conditions. The predominant gaseous species above SiC are Si, SiC_2, and Si_2C. By combining the heat of formation of gaseous Si from solid SiC and the known standard heat of formation of SiC, a value of 113 kcal/g atom is obtained for the heat of sublimation of Si at 298 K. ***J. Drowart, G. De Maria, and Mark G. Inghram.*** *Journal of Chemical Physics,* v. 29, Nov. 1958, p. 1015-1021.

2548 Concerning Reconstructive Transformation and Formation of Glass. An explanation based on kinetic considerations is developed for the failure of some pure liquids to crystallize. The important parameters are the ratio of the molar liquid-solid surface tension to the heat of fusion, the entropy of fusion, the kinetic barrier to nucleation, and the kinetic barrier to the growth of the finite crystal. ***David Turnbull and Morrel H. Cohen.*** *Journal of Chemical Physics,* v. 29, Nov. 1958, p. 1049-1054.

2549* Calcium Chloride in Portland Cement Manufacture. Use of calcium chloride as a flocculating agent for increasing the production of kiln feed slurry filter wheels. ***E. Carl Kreager and Eugene W. Geary.*** *Pit and Quarry,* v. 51, no. 6, Dec. 1958, p. 120 + 2 pages.

2550* New Aspects on the Mineralogical Composition of Silica Bricks, Especially Concerning the So-Called "Glass-Phase". X-ray and dilatometric studies indicate that the modern silica brick contains less than 3% of glassy phase. ***O. W. Flörke.*** *Refractories Journal,* v. 34, Nov. 1958, p. 510-516.

2551 Coloured Patterns in Glass. Describes a means of placing metal deposits in glass to form graticules, drawings, or photographs. ***A. J. C. Hall and J. G. Hayes.*** *Research,* v. 11, Dec. 1958, p. 461-465.

2552* History of the Development of Pyroceram. ***S. D. Stookey.*** *Research Management,* v. 1, no. 3, Autumn 1958, p. 155-163.

2553 Niobium Carbide Coating of Graphite Tubes. Intimate conformity to the graphite surface and improved uniformity were obtained by reacting $NbCl_5$ vapor with the graphite under pressure-temperature conditions thermodynamically unfavorable for the deposition of Nb by thermal dissociation of the chloride, but favorable for the formation of NbC. ***John M. Blocher, Jr., Melvin F. Browning, Don P. Leiter, Jr., and Ivor E. Campbell.*** *U. S. Atomic Energy Commission, BMI-1296,* Oct. 6, 1958, 20 pp. (UF767 U3b Contin.)

See also: **2995** (determination of SiO_2 and ThO_2 particle size); **3465** (magnetic resonance absorption in glass); **3508** (optical absorption and photoconductivity in MgO crystals); **3552** (plastic formlining for concrete); **3636** (metal-ceramic bonds).

CHEMICAL ENGINEERING

2554* Maintenance of Centrifugal Pumps. Practices followed in carrying out repairs of individual pump parts, starting with the maintenance of casings. ***Igor J. Karassik and Roy Carter.*** *Air Conditioning, Heating, and Ventilating*, v. 55, Dec. 1958, p. 86-90.

2555* Efficiency of Evaporative Water Cooling Towers. A new method for calculating the interdependence of temperatures of the air and water streams which exist in an ideal, 100% efficient evaporative cooling tower and which pertains to various counter current air/water flow ratios. ***E. Gottesman.*** *Applied Scientific Research, Sec. A, Mechanics, Heat, Chemical Engineering, Mathematical Methods*, v. 8, no. 1, 1958, p. 28-44.

2556* Domestic Heavy Water—How and When? A brief evaluation of six processes. *Canadian Chemical Processing*, v. 42, Dec. 1958, p. 59 + 2 pages.

2557* Submerged Evaporation and Its Application to Fish Stickwater Recovery. Briefly reviews the scope and historical development of submerged evaporation and discusses its application. Experiments connected with this novel use are given. ***G. A. Carpenter.*** *Chemical & Process Engineering*, v. 39, Dec. 1958, p. 425 + 4 pages.

2558* Evaporation. Reviews the present methods available for estimating heat transfer to boiling liquids and shows that no entirely satisfactory method is at present available. ***J. M. Coulson.*** *Chemical & Process Engineering*, v. 39, Dec. 1958, p. 429-433.

2559 Checkup on Cooling Tower Operation. Four charts quickly convert one set of performance data to any other set of conditions. ***Eugene L. Bass and Nathaniel P. Green.*** *Chemical Engineering*, v. 65, Dec. 1, 1958, p. 111-116.

2560 Estimate Efficiency in Mass Transfer. Reviews methods for calculating over-all, plate and point efficiencies in bubble-cap or sieve-plate columns during distillation or absorption. ***James O. Osburn.*** *Chemical Engineering*, v. 65, Dec. 1, 1958, p. 119-122.

2561 Intense Arc Pierces Temperature Barrier. Producing temperatures at the 15,000-30,000-F level, the high-intensity electric arc opens a completely new environment that engineers are now exploiting. *Chemical Engineering*, v. 65, Dec. 29, 1958, p. 24 + 2 pages.

2562 Chemical Engineering Practice. v. V. Fluid Systems. I. Vacuum, gaseous, liquid, and combined systems are considered in the 12 sections of the book. ***Herbert W. Cremer and Trefor Davies, editors.*** 719 pp. 1958. Academic Press, New York. (TP155 C42c)

2563* The Influence of Surface Phenomena on the Performance of Distillation Columns. In apparatus where the interfacial area is mainly of the film type, mass transfer rates for mixtures causing the surface tension of the reflux to increase may be twice as high (or more) as those in systems in which the surface tension of the reflux decreases. ***F. J. Zuiderweg and A. Harmens.*** *Chemical Engineering Science*, v. 9, nos. 2-3, Nov. 1958, p. 89-103 + 3 plates.

2564* The Final Stage in the Removal of the Lighter Component of a Binary Mixture by Batch Rectification. It is assumed that at phase equilibrium the concentration of the lighter component in the vapor is directly proportional to its concentration in the liquid. ***J. Buiten.*** *Chemical Engineering Science*, v. 9, nos. 2-3, Nov. 1958, p. 104-118.

2565* The Non-Homogeneous Chromatographic Column. The theoretical plate concept in chromatography has been extended to the treatment of the non-homogeneous chromatographic column where the exchange coefficient k is not the same for all the plates in the column. ***A. S. Said.*** *Chemical Engineering Science*, v. 9, nos. 2-3, Nov. 1958, p. 153-163.

2566 Impervious Graphite Rupture Discs Resist Temperature of 250°F. Record service for three years in a formaldehyde plant. ***Gordon Weyermuller.*** *Chemical Processing*, v. 22, Jan. 1958, p. 33-34.

2567 Produces 99% Nitric Acid Free of Sulfates. Employs magnesium nitrate as a desiccant in place of sulfuric acid. ***Gordon Weyermuller and Robert J. Bechtel.*** *Chemical Processing*, v. 22, Jan. 1958, p. 38-39.

2568* Heat Transfer and Partial Distillation in Thin-Film Evaporators. The separation efficiency of a thin-film evaporator has been examined by partial distillation of a two-substance mixture. (*In German.*) Wärmeübergang und Teildestillation in Dünnschichtverdampfern. ***Emil Kirschbaum and Karl Dieter.*** *Chemie-Ingenieur-Technik*, v. 30, Nov. 1958, p. 715-720.

2569* Evaporation Cooling. II. Theory of Evaporation Cooling and Measurement of Heat Transfer in Steel-Hardening Oils and Salt Solutions. The film phase (frost phenomenon) can be explained quantitatively. The temperature of the phase change from the film phase to the boiling phase is hypothetically indicated. (*In German.*) Verdampfungskühlung. II. Theorie der Verdampfungskühlung und Messung des Wärmeübergangs bei Härteölen und Salzlösungen. ***W. Stenzel and R. Schultze.*** *Chemie-Ingenieur-Technik*, v. 30, Nov. 1958, p. 720-728.

2570* Hydrogen Peroxide Works at Warrington. The process adopted for the new plant at the Baronet Works is based on the use of 2-ethyl anthraquinone. *Engineer*, v. 206, Dec. 12, 1958, p. 933-934.

2571 Grignards for Commerce. The first U. S. company to produce Grignard reagents for sale now carries out the Grignard reaction for others on a custom basis. ***David E. Gushee, Richard C. Waugh, and Thomas D. Waugh.*** *Industrial and Engineering Chemistry*, v. 50, Dec. 1958, p. 1712-1718.

2572 Solvent Extraction With Alkyl Amines. Empirical and fundamental studies of the Amex process show that the chemistry of amine extraction parallels anion exchange resin sorption, but with significant differences, important to process, analytical, and physicochemical applications. ***C. F. Coleman, K. B. Brown, J. G. Moore, and D. J. Crouse.*** *Industrial and Engineering Chemistry*, v. 50, Dec. 1958, p. 1756-1762.

2573 The Separation of Ethyl Acetate-Ethanol Ethanol-Water Mixtures. The design and operation of a pilot plant, the methods of analysis used, and the separations which were achieved. ***S. R. M. Ellis and D. Wooldridge.*** *Industrial Chemist*, v. 34, Dec. 1958, p. 649-655.

2574 Fluidized Handling of Fullers Earth. Details of a modern plant for the fluidized earth. This new method of conveying powdered materials can effect economies in time and manpower. ***J. D. Corney.*** *Industrial Chemist*, v. 34, Dec. 1958, p. 656-658.

2575 Production of Heavy Water. Reviews four systems. ***A. S. White.*** *Industrial Chemist*, v. 34, Dec. 1958, p. 671-672.

2576 Antistatic Additives in the Petroleum Industry. Experimental work shows that dangerous accumulations of electric charge in oil products can be satisfactorily prevented by increasing the electrical conductivity of the product with an antistatic agent. ***A. Klinkenberg and B. V. Poulston.*** *Institute of Petroleum, Journal*, v. 44, Nov. 1958, p. 379-393.

2577* Recent Developments in the Manufacture of Chlorine Dioxide. A new patented process employing sodium chlorate, NaCl and sulfuric acid as raw materials, is outlined. ***W. Howard Rapson.*** *Paper Trade Journal*, v. 142, Dec. 29, 1958, p. 18-22.

2578* Billerud AB Pioneers Use of Kamyr Continuous Digester for Neutral Sulphite Semi-Chemical Pulping. Technical details of the plant and operations. ***Eben M. Whitcomb.*** *Paper Trade Journal*, v. 142, Dec. 29, 1958, p. 24-26.

2579* **Solid-Liquid Extraction. VI. Mass Transfer and Equipment for Leaching.** Outlines factors affecting the rates of mass transfer in leaching and indicates how these enter into the design of equipment for leaching operations. Other practical features of leaching equipment. ***D. C. Freshwater.*** *Perfumery and Essential Oil Record,* v. 49, Dec. 1958, p. 844-848.

2580 **Computer Gives Best Splitter Design.** Presents data on a pentane splitter as an example. ***Melvin A. Albright.*** *Petroleum Refiner,* v. 37, Dec. 1958, p. 111-114.

2581* **Aerosol Formulation.** Shows that the development of aerosol products requires a sound theoretical and practical background in all phases of chemistry, plus a thorough knowledge of pertinent economic and regulatory standards. ***Grant L. Armstrong.*** *Soap and Chemical Specialties,* v. 34, Dec. 1958, p. 127 + 3 pages.

2582* **Black Liquor Evaporation. III. Degassing and Hydrogen Sulfide Recovery.** The venting of the vapor side amount and disposal of venting vapor and partial recovery of H_2S are discussed. (*In Swedish.*) Svartlutindunstning. III. Avgasning och svavelväteåtervinning. ***E. Venemark.*** *Svensk Papperstidning,* v. 61, no. 22, Nov. 30, 1958, p. 983-989.

2583* **Polyphosphate Treatment.** Traces the history in the use of these chemicals from the time of initial discovery up to the present day applications. Provides a broader insight and a better understanding of the qualities and applications for the hexametaphosphates. ***Davis E. Speeg.*** *Water & Sewage Works,* v. 105, Dec. 1958, p. 538-540.

See also: **2903** (thermodynamics of the inner friction process); **3066** (corrosion inhibitors in the treatment of water).

CHEMISTRY—ANALYTICAL

2584* **Determination of Rare Earth Metals in Their Mixture.** Ion exchange chromatography proved to be the most suitable method for the quantitative separation and determination of rare earth metals. The method developed appears to be suitable also for determination of the trivalent ions of the actinides in their mixture. ***A. Almásy.*** *Acta Chimica Academiae Scientiarum Hungaricae,* v. 17, no. 1, 1958, p. 55-67.

2585 **A Photometric Determination of Vitamin D in Presence of Vitamin A.** ***M. Schmall, B. Senkowski, R. Colarusso, E. G. Wollish, and E. G. E. Shafer.*** *American Pharmaceutical Association, Journal (Scientific Ed.),* v. 47, Dec. 1958, p. 839-844.

2586* **The Determination of Impurities in Carbon Dioxide by Gas Chromatography, With Special Reference to Coolant Gas for Nuclear Reactors.** With a 25-ml sample, H, Ar, O, N, CH_4, and CO present at levels as low as 5 to 20 p.p.m. in CO_2 can be determined by a gas-chromatographic method. ***D. G. Timms, H. J. Konrath, and R. C. Chirnside.*** *Analyst,* v. 83, Nov. 1958, p. 600-609.

2587* **The Separation of Fluoride Ions From Interfering Anions and Cations by Anion Exchange Chromatography.** Fluoride may be separated from phosphate and the anionic metal chelates of EDTA by absorption on, and elution from, an anion exchange column containing a strongly basic resin. ***A. C. D. Newman.*** *Analytica Chimica Acta,* v. 19, no. 5, Nov. 1958, p. 471-476.

2588* **Determination of Thallium by a Dithizone Mixed-Color Method.** Analytical procedure based on the absorption spectra of the thallium-dithizone mixed-color system. ***Roy S. Clarke, Jr. and Frank Cuttitta.*** *Analytica Chimica Acta,* v. 19, no. 6, Dec. 1958, p. 555-562.

2589* **Rapid and Accurate Automatic Titration of Calcium and Magnesium in Dolomites and Limestones. Use of EDTA Titrant and Automatic Derivative Spectrophotometric End-Point Termination.** ***H. V. Malmstadt and T. P. Hadjiioannou.*** *Analytica Chimica Acta,* v. 19, no. 6, Dec. 1958, p. 563-569.

2590* **Potentiometric Titrations With an Attackable Electrode. The Bimetallic Electrode Pair Platinum-Tungsten.** ***I. M. Kolthoff and E. R. Nightingale, Jr.*** *Analytica Chimica Acta,* v. 19, no. 6, Dec. 1958, p. 593-600.

2591 **Quantitative Infrared Analysis of Pesticides in the Solid State.** Use of the KBr pellet technique for quantitative analysis of pesticides is feasible, provided that samples with known composition are studied beforehand and uniform grinding and mixing procedures are employed. ***Heino Susi and H. E. Rector.*** *Analytical Chemistry,* v. 30, Dec. 1958, p. 1933-1935.

2592 **Gas-Liquid Partition Chromatography. Determination of 2,6-Di-*tert*-butyl-*p*-cresol on Antioxidant-Treated Paperboard.** ***Edward C. Jennings, Jr., T. David Curran, and David G. Edwards.*** *Analytical Chemistry,* v. 30, Dec. 1958, p. 1946-1948.

2593 **Separation of Saturated Hydrocarbons From Petroleum Residues.** Chromatographic adsorption procedure not requiring preliminary removal of asphaltenes and resins has been developed for the isolation of the saturated hydrocarbons from crude oil residues. ***R. D. Schwartz and D. J. Brasseaux.*** *Analytical Chemistry,* v. 30, Dec. 1958, p. 1999-2002.

2594 **An Electrode System for Measuring Dissolved Oxygen.** The device described is temperature-compensated and, because of the selectivity of the membrane separating the electrodes from the environment, will function satisfactorily in a wide variety of aqueous systems. ***Dayton E. Carritt and John W. Kanwisher.*** *Analytical Chemistry,* v. 31, Jan. 1959, p. 5-9.

2595 **Thermal Electroanalysis.** Method based on differential thermal measurements during electrolysis. ***Howard F. Holmes and Michael J. Joncich.*** *Analytical Chemistry,* v. 31, Jan. 1959, p. 28-32.

2596 **Radiochemical Separation of Fission Products From Large Volumes of Sea Water.** Chemical methods were used to isolate 28-year Sr-90, 30-year Cs-137, 280-day Ce-144, and 2.4-year Pm-147. ***T. T. Sugihara, H. I. James, and E. J. Troianello.*** *Analytical Chemistry,* v. 31, Jan. 1959, p. 44-49.

2597 **Determining Molecular Structure by Nuclear Magnetic Resonance of Hydrogen.** A method for rapid and accurate determination of important features of the molecular structure of hydrocarbons and their derivatives, for either pure compounds or mixtures of compounds. ***Nugent F. Chamberlain.*** *Analytical Chemistry,* v. 31, Jan. 1959, p. 56-77.

2598 **Selective Reactivity in Gas-Liquid Chromatography. Determination of 2-Bromobutane and 1-Bromo-2-methylpropane.** ***W. E. Harris and W. H. McFadden.*** *Analytical Chemistry,* v. 31, Jan. 1959, p. 114-117.

2599 **Some Factors in Ultraviolet Densitometry of Amino Acid Chromatograms.** ***Helene Ven Horst, Helen Tang, and Veronica Jurkovich.*** *Analytical Chemistry,* v. 31, Jan. 1959, p. 135-138.

2600 **Determination of Acetylene in Air in Concentrations From Ten Parts Per Billion to Ten Parts Per Million.** ***Ernest E. Hughes and Ralph Gorden, Jr.*** *Analytical Chemistry,* v. 31, Jan. 1959, p. 94-98.

2601* **Gas Chromatography of Aromatic Amines and Nitro Compounds.** ***J. H. Jones, C. D. Ritchie, and K. S. Heine, Jr.*** *Association of Official Agricultural Chemists, Journal,* v. 41, no. 4, Nov. 1958, p. 749-752.

2602* **Separation and Identification of Chlorinated Organic Pesticides by Paper Chromatography. XI. A Study of 114 Pesticide Chemicals: Technical Grades Produced in 1957 and Reference Standards.** ***Lloyd C. Mitchell.*** *Association of Official Agricultural Chemists, Journal,* v. 41, no. 4, Nov. 1958, p. 781-816.

2603* **Gas Chromatography. II. Application to Gases in the Industrial Laboratory.** Report on gas chromatographic analysis of gaseous hydrocarbons with up to 30 components. Individual determination within the range of 0.01-99.8 vol. %. Description of an apparatus using the thermal conductivity method and allowing the analysis of a hydrocarbon mixture

within three hours. (*In German.*) Über die Gaschromatographie. II. Anwendung auf Gase im Industrielaboratorium. ***O. Horn, U. Schwenk, and H. Hachenberg.*** *Brennstoff-Chemie*, v. 39, nos. 21/22, Nov. 1958, p. 336-346.

2604* Chlorine in Distilled Water as a Source of Laboratory Error. One p.p.m. of free Cl in distilled water will inhibit markedly the color development in the usual determinations of uric acid and bilirubin. The effect on other clinical chemistry determinations is discussed and simple tests for the detection of free Cl in water are reviewed. ***Wendell T. Caraway.*** *Clinical Chemistry*, v. 4, no. 6, Dec. 1958, p. 513-518.

2605 The Rapid Analysis of Coal Ash, Slag and Boiler Deposits. Complete analysis of inorganic residues from coal; these methods are of general applicability to the analysis of coal ash, clinker, slag, boiler dusts, and deposits. ***K. Archer, D. Flint, and J. Jordan.*** *Fuel*, v. 37, no. 4, Oct. 1958, p. 421-443.

2606* Isolation and Identification of an Ester From a Crude Oil. A dioctylphthalate has been isolated from a crude oil by means of adsorption column chromatography. The ester was identified by means of elemental analysis, refractive index, and its infra-red absorption spectrum. ***H. F. Phillips and I. A. Breger.*** *Geochimica et Cosmochimica Acta*, v. 15, nos. 1-2, Nov. 1958, p. 51-56.

2607 Acaricide Residues. Colorimetric Microdetermination of the Acaricide 2,4,5,4′-Tetrachlorodiphenyl Sulfone. A method responding in the range of 5 to 50 γ of Tedion. ***O. H. Fullmer and C. C. Cassil.*** *Journal of Agricultural and Food Chemistry*, v. 6, Dec. 1958, p. 906-908.

2608 Potentiometric Titrations of Weak Acids in Non-Aqueous Solvents. I. Benzoic Acid, *c*-Cyclohexylcaproic Acid, *p*-Cresol and α-Naphthol. II. Hydroxybenzoic Acids and Dihydric Phenols in *n*-Butylamine. ***D. H. Mathews and T. R. Welch.*** *Journal of Applied Chemistry*, v. 8, pt. 11, Nov. 1958, p. 701-715.

2609* Metallic Nitrates in Paper Chromatography. II. The System Methyl Isobutyl Ketone-Nitric Acid-Lithium Nitrate-Water. III. The System Di-isopropyl Ether-Nitric Acid-Water. I-II. ***A. S. Kertes and A. H. I. Ben-Bassat.*** III. ***A. S. Kertes and A. Beck.*** *Journal of Chromatography*, v. 1, no. 6, Nov. 1958, p. 489-500.

2610* Gas Liquid Partition Chromatography of Mixtures of Methylenecyclohexane and the Isomeric Methylcyclohexenes. ***E. Gil-Av, J. Herling, and J. Shabtai.*** *Journal of Chromatography*, v. 1, no. 6, Nov. 1958, p. 508-512.

2611* A Gas-Liquid Chromatographic Method for Volatile Fatty Acids in Milk. Analysis for formic, acetic, propionic, butyric, valeric, caproic, and caprylic acids can be completed in 90 min. ***C. L. Hankinson, W. J. Harper, and E. Mikolajcik.*** *Journal of Dairy Science*, v. 41, Nov. 1958, p. 1502-1509.

2612 Determination of Zinc in Aluminium and Copper Alloys. An anion exchange method. Range is 0.1 to 6% Zn. ***M. Freegarde.*** *Metallurgia*, v. 58, Nov. 1958, p. 261-262.

2613* The Microanalytical Determination of Oxygen in Organic Substances. The potentiometric determination of O as CO_2 with automatic titration affords a distinct saving of time and work as opposed to the methods used heretofore. (*In German.*) Beiträge zur mikroanalytischen Bestimmung des Sauerstoffes in organischen Substanzen. ***F. Ehrenberger, S. Gorbach, and W. Mann.*** *Mikrochimica Acta*, 1958, no. 6, p. 778-788.

2614* Micro Detection of Hydrogen in Organic Compounds. Organic compounds containing H, no matter what their kind, yield H_2S when heated to 220-250 C in molten sulfur. A micro method for detecting H in organic materials is based on this finding. ***Fritz Feigl and Erwin Jungreis.*** *Mikrochimica Acta*, 1958, no. 6, p. 812-814.

2615* Absorptiometric Determination of Traces of Copper in Rubber Chemicals and Products. The method is based on treating the sample under test with zinc dibenzyl dithiocarbamate reagent and simultaneously extracting the Cu complex thus formed with CCl_4 in an acid medium. ***R. C. Madan.*** *Rubber Age*, v. 84, no. 3, Dec. 1958, p. 451-454.

2616* Analytical Applications of Far Infrared Spectra. I. Historical Review, Apparatus, and Technique. ***F. F. Bentley, E. F. Wolfarth, Nora E. Srp, and W. R. Powell.*** *Spectrochimica Acta*, v. 13, nos. 1-2, Nov. 1958, p. 1-30 + 1 plate.

2617* Paper Electrophoresis. A review of the technique and applications of paper electrophoresis. Experimental modifications, which improve the degree and quality of the separation. Examples of the separation of acidic saccharides, carbonyl compounds, and phenols. (*In Swedish.*) Papperselektrofores. ***Olof Theander.*** *Svensk Kemisk Tidskrift*, v. 70, no. 10, 1958, p. 393-404.

2618* A New Spectrophotometric Determination of Small Amounts of Titanium in Steel and Ferroalloys. I. Determination of Titanium in Steel and Cast Iron. II. Determination of Titanium in Metallic Manganese, Ferromanganese, Metallic Silicon, Ferrosilicon and Silicomanganese. III. Determination of Titanium in Metallic Chromium, Ferrochromium, Ferrotungsten, Ferromolybdenum and Ferrovanadium. Sodium alizarin sulfonate is used. I. ***Hidehiro Goto, Yachiyo Kakita, and Kichinosuke Hirokawa.*** II-III. ***Hidehiro Goto and Kichinosuke Hirokawa.*** *Tōhoku University, Science Reports of the Research Institutes, Ser. A. Physics, Chemistry, Metallurgy*, v. 10, no. 5, Oct. 1958, p. 356-374.

2619 Metal-Indicator Systems in (Ethylenedinitrilo) Tetraacetic Acid Titrations. Three organic reagents have been studied and applied to titrations with EDTA. The techniques of photometric titrations and precision spectrophotometry have been applied to titrations of rare earths as dilute as 10^{-4} *M*. ***William J. Lane and J. S. Fritz.*** *U. S. Atomic Energy Commission, ISC-945*, Dec. 1957, 110 pp. (UF767 Un3.1is Contin.)

See also: **2541** (determination of boron in glass); **2920** (flame photometer for Na aerosol); **2967** (determination of "internal gelatin" in Ag halide grains); **2993** (IR spectrography); **3585** (separating atmospheric pollutants).

CHEMISTRY—INORGANIC AND GENERAL

2620* Decomposition of Hydrogen Peroxide in an Alkaline Solution in the Presence of a Copper Citrate Complex. (*In German.*) Über die Zersetzung des Wasserstoffperoxyds in alkalischem Medium bei Anwesenheit eines Kupfer(II) citratkomplexes. ***L. Erdey and J. Inczédy.*** *Acta Chimica Academiae Scientiarum Hungaricae*, v. 17, no. 1, 1958, p. 93-111.

2621 Chemistry of Some Sulfur Oxyfluorides. Reactions of SO_3 with inorganic fluorides, mainly those of the Group II and Group VA elements were studied. ***E. L. Muetterties and D. D. Coffman.*** *American Chemical Society, Journal*, v. 80, Nov. 20, 1958, p. 5914-5918.

2622* A Study of Ion Self Diffusion in Alkaline Halides. Self diffusion of ions in single crystals and in polycrystalline aggregates of different potassium halides (KF, KCl, KBr, KI), of different alkaline chlorides (NaCl, KCl, CoCl), and of CsF, was studied as function of temperature by using the radioactive isotopes of the different elements. (*In French.*) Étude de l'autodiffusion des ions dans les halogénures alcalins. ***Jean François Laurent.*** *Annales de Chimie*, v. 3, Sept.-Oct. 1958, p. 712-769.

2623 Infrared Spectra and Structure of Selenious Acid. Infrared spectra of selenious acid, both crystalline and in solution in water and methanol, were recorded from 2 to 30μ. ***Michael Falk and Paul A. Giguère.*** *Canadian Journal of Chemistry*, v. 36, Dec. 1958, p. 1680-1685.

2624 Halogen Fluorides and Other Covalent Fluorides. Physical and chemical properties, isotopic exchange reactions, and nuclear magnetic resonance spectra. ***Howard C. Clark.*** *Chemical Reviews*, v. 58, no. 5, Oct. 1958, p. 869-894.

2625 Metal Complexing by Phosphates. Complexing by orthophosphates. Complexing by chain and ring phosphates. ***John R. Van Wazer and Clayton F. Callis.*** *Chemical Reviews*, v. 58, no. 6, Dec. 1958, p. 1011-1046.

2626 Biscyclopentadienylrhenium Hydride. Preparation, properties, and high-resolution nuclear magnetic resonance and infrared spectra of the compound and its salts. ***M. L. H. Green, L. Pratt, and G. Wilkinson.*** *Chemical Society, Journal*, 1958, Nov., p. 3916-3922.

2627* Studies on the Synthesis of Metal Complexes. IV. The Cobalt(III) Complexes of Ammoniatriacetic Acid. ***Motoshichi Mori, Muraji Shibata, Eishin Kyuno, and Yoshito Okubo.*** *Chemical Society of Japan, Bulletin*, v. 31, no. 8, Nov. 1958, p. 940-944.

2628* Concerning Aromatic Complexes From Metals. XXI. Di-cyclopentadienyl-Rhodium(II) by Means of Elementary Transformation From Di-cyclopentadienyl-Ruthenium(II). Detection of uncharged di-cyclopentadienyl rhodium(II), Rh $(C_5H_5)_2$, formed by neutron radiation from ruthenocene. The compound can be readily sublimed and oxidized. (*In German.*) Über Aromatenkomplexe von Metallen. XXI. Di-cyclopentadienyl-rhodium(II) durch Elementumwandlung aus Di-cyclopentadienyl-ruthenium(II). ***Franz Baumgärtner, Ernst Otto Fischer, and Ursula Zahn.*** *Chemische Berichte*, v. 91, no. 11, 1958, p. 2336-2341.

2629 The Preparation of Anhydrous Inorganic Chlorides by Dehydration With Thionyl Chloride. The anhydrous chlorides of a number of the lanthanides, Th, Mg, and other elements, have been prepared by refluxing the hydrated chlorides with thionyl chloride. The method is of general application to elements whose oxides are not acidic or amphoteric and which are not oxidized by thionyl chloride. ***J. H. Freeman and M. L. Smith.*** *Journal of Inorganic and Nuclear Chemistry*, v. 7, no. 3, Oct. 1958, p. 224-227.

2630 Acidic Esters of Orthophosphoric Acid as Selective Extractants for Metallic Cations—Tracer Studies. ***D. F. Peppard, G. W. Mason, W. J. Driscoll, and R. J. Sironen.*** *Journal of Inorganic and Nuclear Chemistry*, v. 7, no. 3, Oct. 1958, p. 276-285.

2631 Properties of SF_4 and Its Adduct With BF_3. Some new data on the adduct of SF_4 with BF_3 are reported and arguments are given to indicate that the adduct is quite unlikely to be a donor-acceptor complex. ***F. A. Cotton and J. W. George.*** *Journal of Inorganic and Nuclear Chemistry*, v. 7, no. 4, Nov. 1958, p. 397-403.

2632 Reactions of Carbon Dioxide With Sodium and Lithium Borohydrides. ***T. Wartik and R. K. Pearson.*** *Journal of Inorganic and Nuclear Chemistry*, v. 7, no. 4, Nov. 1958, p. 404-411.

2633 Some Problems in the Stereochemistry of Coordination Compounds. Every coordination number from two to eight is exhibited by inorganic compounds, and for each coordination number except six, compounds of at least two configurations are known. This paper is limited to chemical studies on compounds illustrating the coordination number four and six. ***John C. Bailar, Jr.*** *Journal of Inorganic & Nuclear Chemistry*, v. 8, 1958, p. 165-175.

2634 New Iridium Carbonylderivatives. Preliminary Communication: Potassium Chloro- and Bromocarbonyliridates. A new class of carbonyliridium derivatives is described, that is the halogenocarbonyliridiates of the types: $K[Ir(CO)_2Cl_{2\text{-}3}]$; $K[Ir(CO)_2Br_{2\text{-}3}]$; $K[Ir(CO)Br_3]$; $K[Ir(CO)Br_4]$. ***Lamberto Malatesta and Maria Angoletta.*** *Journal of Inorganic & Nuclear Chemistry*, v. 8, 1958, p. 273-276.

2635 Complexes Derived From (RuNO) III and Ru IV. Nitrato, nitro, and nitrito groups in various diamagnetic complexes of nitrosylruthenium have been recognized chemically or spectroscopically (infra-red) in preparations derived from aqueous HNO_3 or from organic solutions. ***John M. Fletcher.*** *Journal of Inorganic and Nuclear Chemistry*, v. 8, 1958, p. 277-287.

2636* The Problem of Polarographic Reduction of Some Polyvalent Cations. Experimental data concerning the mechanism of the polarographic reduction of Al ions as a reaction of the reduction of the labile molecules of water (or hydrogen ions) from the aqueous envelope of the Al^{+++} ion with generation of H_2 and formation of $Al(OH)_3$ on the Hg drop. (*In Russian.*) K voprosu o poliarograficheskom vosstanovlenii nekotorykh mnogozariadnykh kationov. ***Ia. P. Stradin' and L. K. Lepin'.*** *Latvijas PSR Zinatnu Akademijas Vestis*, 1958, no. 9, p. 97-104.

2637* The Chemistry of Ferromagnetic Iron Oxides. Synthetic magnetite (ferrous ferrite) can be prepared as a result of partial oxidation of $Fe(OH)_2$ gel, as well as synthetically from iron hydroxides and oxides submitted to the reaction with $Fe(OH)_2$ in alkaline medium. (*In Polish.*) Chemia ferromagnetycznych tlenków żelaza. ***Alfons Krause.*** *Przemysł Chemiczny*, v. 37, no. 10, Oct. 1958, p. 637-639.

2638* Infrared Absorption Spectra of Inorganic Co-Ordination Complexes. XVII. Infrared Spectra of Platinum(II) and Palladium(II) Ammine Complexes. ***San-Ichiro Mizushima, Ichiro Nakagawa, M. J. Schmelz, C. Curran, and J. V. Quagliano.*** *Spectrochimica Acta*, v. 13, nos. 1-2, Nov. 1958, p. 31-37.

See also: **2990** (chemical literature of Belgium).

CHEMISTRY—ORGANIC

2639* On the Reactions in Syntheses of Polyamines With Phthalimino Alkyl Haloids. I. (*In German.*) Über Reaktionen in Polyaminsynthesen mit Phthaliminoalkylhaloiden. I. ***K. Körmendy.*** *Acta Chimica Academiae Scientiarum Hungaricae*, v. 17, no. 2, 1958, p. 255-264.

2640 Advances in Carbohydrate Chemistry. Formation and cleavage of the oxygen ring in sugars; the Lobry De Bruyn-Alberda Van Ekenstein transformation; the formazan reaction in carbohydrate research; the four-carbon saccharinic acids; the methyl ethers of 2-amino-2-deoxy sugars; glycosyl ureides; the nonulosaminic acids; polysaccharide hydrocolloids of commerce; alkaline degradation of polysaccharides; starch nitrate. ***Melville L. Wolfrom and R. Stuart Tipson, editors.*** v. XIII. 387 pp. Academic Press, New York. (QD321 A95 Vis.)

2641* The Synthesis of 2-Methyl- and 3-Methyl-1-thiaindanes and 2-Ethylthiaindene. (*In Russian.*) Sintez 2-metil- i 3-metil-1-tiaindanov i 2-etiltiaindena. ***E. N. Karaulova, D. Sh. Meilanova, and G. D. Galpern.*** *Akademiia Nauk SSSR, Doklady*, v. 123, no. 1, Nov.-Dec. 1958, p. 99-101.

2642* Synthesis of Steroid Compounds and Related Substances. XL. Synthesis of Steroid Analogs Lacking Either B or C Cycle. Principles of obtaining a series of model steroid analogs lacking either B or C cycles and related to derivatives of napthalene and biphenyl. (*In Russian.*) Sintez steroidnykh soedinenii i rodstvennykh im veshchestv. XL. Sintez steroidnykh analogov, ne soderzhashchikh kol'tsa B ili C. ***I. N. Nazarov and S. I. Zav'ialov.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1958, no. 10, Oct., p. 1233-1238.

2643* Synthesis of Sulfur Compounds on the Basis of Vinyl Ethers and Acetylene. XVII. Vinyl Ethers of Monothioethyleneglycol. XVIII. S-Vinylmercaptobenzthiazol. (*In Russian.*) Sintez sernistykh veshchestv na osnove vinilovykh efirov i atsetilena. ***M. F. Shostakovskii, E. N. Prilezhaeva, and N. I. Uvarova.*** XVIII. S-Vinilmerkaptobenzotiazol. ***M. F. Shostakovskii, E. N. Prilezhaeva, and V. M. Karavaeva.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1958, no. 10, Oct., p. 1245-1253.

2644 Some Reactions of Silyllithium Compounds With Ethers. Silyllithium compounds were found to react with trimethylene oxide and tetrahydrofuran, giving rise to 3- and 4-silyl-substituted carbinols. Tetrahydropyran was polymerized by triphenylsilyllithium at elevated temperatures. Methyl-triphenylsilane resulted from the reaction of the latter with 1,2-dimethoxyethane, whereas with dioxane, ethylene-bis-(triphenylsilane) was formed. With diphenyl ether and benzyl methyl ether, apparently metalation occurred and secondary products resulted. ***Dietmar Wittenberg, Dan Aoki, and Henry Gilman.*** *American Chemical Society, Journal*, v. 80, Nov. 20, 1958, p. 5933-5936.

2645 Organic Phosphorus Compounds. IV. A Study of the Transesterification of Dialkyl Alkylphosphonites. A study of the effect of the reactant ratio on the composition of the reaction mixture obtained by transesterification of diethyl methyl- and of diethyl ethylphosphonite with 1-octanol demonstrated that this reaction proceeds for all practical purposes by random distribution of the alkoxy groups. ***Friedrich W. Hoffmann, Robert G. Roth, and Thomas C. Simmons.*** *American Chemical Soicety, Journal,* v. 80, Nov. 20, 1958, p. 5937-5940.

2646 Applications of the Hammett Equation to Non-Aromatic Unsaturated Systems. I. *trans*-3-Substituted Acrylic Acids. Dissociation constants for *trans*-3-substituted acrylic acids, *trans*-3-methyl-3-substituted acrylic acids, and trans-3-carboxy-3-substituted acrylic acids are correlated with the Hammett equation. The p-values and correlation coefficients are 2.230, 0.975; 2.977, 0.991; and 1.918, and 0.925, respectively. New substituent constants are calculated for a number of substituents. ***Marvin Charton and Herbert Meislich.*** *American Chemical Society, Journal,* v. 80, Nov. 20, 1958, p. 5940-5943.

2647 The Ether Hydrolysis of Some Halogen Substituted Phenoxyacetic Acids. The rates of ether hydrolysis of phenoxyacetic acid and of 2-fluoro, chloro, and bromo, of 4-fluoro, chloro, and bromo, of 2,4-difluoro, and dichlorophenoxyacetic acids in concentrated hydriodic acid at 100 and 115 C are slow, k being of the order 10^{-5} to 10^{-6} sec.$^{-1}$. The effect of halogen substitution was small. ***Ronald F. Brown and Elizabeth F. Claflin.*** *American Chemical Society, Journal,* v. 80, Nov. 20, 1958, p. 5960-5963.

2648 The Hydrazinolysis of Methyl Acetate. The reaction of methyl acetate and hydrazine in benzene solution in the presence of methanol was studied. The reaction was first order in both hydrazine and ester when the molar ratio of ester to hydrazine was 1:2, but became first order in ester and second order in hydrazine at ratios of 1:1 to 2:1. ***Robert N. Washburne, John G. Miller, and Allan R. Day.*** *American Chemical Society, Journal,* v. 80, Nov. 20, 1958, p. 5963-5965.

2649 Allylic Rearrangements. XLIII. Some Studies of the Thermal Decomposition of Allyl Chlorosulfinate-1-C^{14}. Allyl chlorosulfinate-1-C^{14} was decomposed thermally to allyl chloride and SO_2 in a variety of solvents. Through the use of special experimental techniques, the chlorosulfinate ester has been decomposed with quantitative allylic rearrangement in the solvent *n*-decane and with varying degrees of preservation of structure in other solvents. ***S. H. Sharman, et al.*** *American Chemical Society, Journal,* v. 80, Nov. 20, 1958, p. 5965-5971.

2650 Sodium-Catalyzed Side Chain Aralkylation of Alkylbenzenes With Styrene. Toluene and ethylbenzene react as above to form monoadducts, 1,3-diphenylpropane and 1,3-diphenylbutane, and diadducts, 1,3,5-triphenylpentane and 1,3,5-triphenylhexane, respectively. ***Herman Pines and Dieter Wunderlich.*** *American Chemical Society, Journal,* v. 80, Nov. 20, 1958, p. 6001-6004.

2651 The Reaction of Olefins With Aromatic Substances in the Presence of Mercury Salts and Catalyst. II. Synthesis of β-Arylethyl Alcohols and *sym*-Diarylethanes. Three of the common alkylation catalysts were found to be effective. Good yields of β-arylethyl alcohols or their acetates can be obtained by this reaction, their relative abundance in the reaction product depending on the catalyst and reaction conditions. ***Katsuhiko Ichikawa, Susumu Fukushima, Hajime Ouchi, and Minoru Tsuchida.*** *American Chemical Society, Journal,* v. 80, Nov. 20, 1958, p. 6005-6009.

2652 Deuterium Isotope Effects in Some Friedel-Crafts Cyclizations of 2-(2-Deuteriophenyl)-benzoyl Chloride. 2-(2-Deuteriophenyl)-benzoyl chloride has been cyclized in various solvents with the catalysts $AlCl_3$, $SnCl_4$, and $ZnCl_2$ to give fluorenone. The isotope effects observed for these reactions have been found to vary with the nature of the catalyst and the reaction medium. ***Donald B. Denney and Peter P. Klemchuk.*** *American Chemical Society, Journal,* v. 80, Nov. 20, 1958, p. 6014-6016.

2653 Formation of Cyclohexadienones by Direct Alkylation of Phenols With Saturated Alkyl Derivatives. Factors affecting the position of methylation of salts of 2,6-dimethylphenol in non-polar medium have been investigated. It has been found that, in toluene, methyl iodide alkylates sodium 2,6-dimethylphenoxide with a ratio of attack on oxygen relative to attack in the *ortho* positions some 30 times as great as the corresponding ratio with benzyl chloride. It is estimated also that benzyl iodide undergoes alkylation several hundred times faster than methyl iodide. The aluminum and bromomagnesium salts of this phenol react too slowly to be useful. ***David Y. Curtin and Robert R. Fraser.*** *American Chemical Society, Journal,* v. 80, Nov. 20, 1958, p. 6016-6020.

2654 Base Catalysis of the Reaction of N-Methylaniline With 2,4-Dinitrofluorobenzene. Proof of the Intermediate Complex Mechanism for Aromatic Nucleophilic Substitution. The reaction of N-methylaniline with 2,4-dinitrofluorobenzene is sensitive to base catalysis, whereas reactions with the corresponding Cl and Br compounds are not. In ethanol, the catalyzed rate is linearly dependent on potassium acetate concentration. In 60% dioxane-40% water, the catalyzed rate shows less than linear response to hydroxide ion concentration at higher concentrations of the base. ***J. F. Bunnett and John J. Randall.*** *American Chemical Society, Journal,* v. 80, Nov. 20, 1958, p. 6020-6030.

2655 Labilization of Ester Bonds in Aminocyclitol Derivatives. I. Derivatives of *myo*- and *scyllo*-Inositols and of Streptamine. The neutral hydrolysis of acetate esters in the *scyllo* and *myo* series of tertiary and quaternary deoxyaminoinositol derivatives has been briefly studied as a function of over-all molecular conformation. A definite increment in ester labilization is imparted to one or more acetate functions by their incorporation into the *scyllo* conformation, as compared with *myo* structures. This additional lability extends to diamino cyclitols in the *scyllo* or streptamine series, in which all six substituents are also in the all-*trans* configuration. A possible explanation for increased ease of acetate hydrolysis as indicated by structure in the *scyllo* derivatives is thought to be centered about increased steric accessibility and/or internal assistance to hydrolysis by oriented ring intermediates. ***G. F. Holland, R. C. Durant, S. L. Friess, and B. Witkop.*** *American Chemical Society, Journal,* v. 80, Nov. 20, 1958, p. 6031-6035.

2656 Determination of the Absolute Configuration of Restricted 1,1'-Binaphthyls by Asymmetric Meerwein-Ponndorf-Verley Reduction. ***Kurt Mislow and Francis A. McGinn.*** *American Chemical Society, Journal,* v. 80, Nov. 20, 1958, p. 6036-6038.

2657 Interaction of Xylenes With Ethylbenzene. Ethylbenzene and each of the xylenes interact at 60 C in the presence of excess HF and BF_3 to yield benzene and 1,3-dimethyl-5-ethylbenzene (5-ethyl-*m*-xylene) as end products. ***M. C. Hoff.*** *American Chemical Society, Journal,* v. 80, Nov. 20, 1958, p. 6046-6049.

2658 The Synthesis of 7-Methyl-, 10-Methyl-, 6,7-Dimethyl- and 7,10-Dimethyl-3,4-Benzpyrenes. ***Joseph L. Comp and Guido H. Daub.*** *American Chemical Society, Journal,* v. 80, Nov. 20, 1958, p. 6049-6052.

2659 Phenyl- and Benzyl-Malonohydroxamic Acids and Their Rearrangements. Phenyl- and benzyl-malonohydroxamic acids were prepared as Na salts by reaction of the corresponding ethyl esters with hydroxylamine and sodium ethoxide. Cupric salts were prepared from the Na salts, but only non-crystalline hydroxamic acids could be obtained from any of the salts. The Na salts readily were acylated by acetic anhydride or benzoyl chloride. Rearrangement of the Na salts with toluenesulfonyl chloride led to the formation of 5-phenyl- or 5-benzyl-3-*p*-tolylsulfonoxyhydantoin. Rearrangement of the benzoyl derivative of phenylmalono-hydroxamic acid gave rise to a different substance having the properties of a "diphenylhydantil". ***Charles D. Hurd and Aristotle G. Prapas.*** *American Chemical Society, Journal,* v. 80, Nov. 20, 1958, p. 6053-6057.

2660 Studies on 4-Substituted-β-Naphthoquinones. The infrared curves of 1,2-dihydroxy-3-aceto-4-cyanonaphthalene and 2,3-dihydroxy-acetophenone are discussed. A comparison between the ultraviolet curves of 1,2-←diacetoxy-4-cyanonaphthalene and 1,2-diacetoxy-3-aceto-4-cyanonaphthalene is discussed. The photochemical reaction of some aldehydes with β-naphthoquinone, 4-cyanomethyl-1,2-naphthoquinone, 4-chloro-1,2-naph-

thoquinone and 4-aryloxy-1,2-naphthoquinones is investigated. The 4-aryloxy-1,2-naphthoquinones are prepared by the interaction of 4-chloro-1,2-naphthoquinone and phenols in the presence of pyridine. ***William Ibrahim Awad and Mohamed Shawkey Hafez.*** *American Chemical Society, Journal*, v. 80, Nov. 20, 1958, p. 6057-6060.

2661 Aminophenylethanols and Related Compounds. Preparation by condensation of styrene oxide and secondary amines or by amination of 2-bromo-2-phenylethanol. ***Seymour L. Shapiro, Harold Soloway and Louis Freedman.*** *American Chemical Society, Journal*, v. 80, Nov. 20, 1958, p. 6060-6064.

2662 Steroids. XCIX. Synthesis of Ring B Oxygenated Estrogens. C. Synthesis of 19- Nor- Δ 4-Pregnene-11β, 17α, 21-triol-3,20-dione (19-Norhydrocortisone) and Related 19-Nor-adrenal Hormones. CI. 19-Nordihydrotestosterone Derivatives. CII. Synthesis of 19-Norprogesterone From Estrone. XCIX. ***J. Iriarte, H. J. Ringold and Carl Djerassi.*** C. ***A. Zaffaroni, et al.*** CI. ***A. Bowers, H. J. Ringold, and E. Denot.*** CII. ***J. S. Mills, H. J. Ringold, and Carl Djerassi.*** *American Chemical Society, Journal*, v. 80, Nov. 20, 1958, p. 6105-6121.

2663 Oxidation of Olefins With Potassium Permanganate in Oil/Water Emulsion. Oxidation of water-insoluble olefins, such as oleic and undecylenic acids, cyclohexene, and 1-octadecene, was conducted in oil/water emulsions, using a nonionic emulsifier. The oxidizing power of $KMnO_4$ increases with reduction in pH and, when olefin content exceeds permanganate content in the systems, pH is the most important factor in determining the mode of reaction and the type of oxidized products formed. ***Joseph E. Coleman and Daniel Swern.*** *American Oil Chemists' Society, Journal*, v. 35, Dec. 1958, p. 675-679.

2664 Mono-Derivatives of Methylene Citric Acid. Synthesis of selected mono-amides and mono-esters of this dibasic acid. ***Austin Dulin and John W. Martin, Jr.*** *American Pharmaceutical Association, Journal (Scientific Ed.)*, v. 47, Dec. 1958, p. 851-852.

2665 Glutarimides V. Synthesis of 2-Allyl-2-Phenylglutarimide. ***Mathias P. Mertes, Jr. and Charles O. Wilson.*** *American Pharmaceutical Association, Journal (Scientific Ed.)*, v. 47, Dec. 1958, p. 882-885.

2666* Simple Synthesis and Chemical Behavior of Recently Discovered Heterocyclic Ring Systems. Thiazolines-Δ3 and related substances are discussed. (*In German.*) Einfache Synthesen und chemisches Verhalten neuer heterocyclischer Ringsysteme. ***F. Asinger and M. Thiel.*** *Angewandte Chemie*, v. 70, nos. 22-23, Nov. 26, 1958, p. 667-683.

2667* Tetraalkyl-Monothiopyrophosphates—Their Preparation and Properties. (*In German.*) Monothio-pyrophosphorsäure-tetraalkylester—ihre Herstellung und ihre Eigenschaften. ***G. Schrader, W. Lorenz, and R. Mühlmann.*** *Angewandte Chemie*, v. 70, nos. 22-23, Nov. 26, 1958, p. 690-694.

2668* An Improved Method of Preparing 3.5-Dichlorobenzaldehyde. A new route for the synthesis of the aldehyde. It was identified by converting it to the corresponding *trans*-cinnamic acid, the infrared spectrum of which is given. ***Sven Lindenfors.*** *Arkiv för Kemi*, v. 13, nos. 1-2, 1958, p. 133-136.

2669* An Investigation of the Association of Phenol With Isopropoxymethyl-Phosphoryl Fluoride (Sarin) and Some Related Compounds. ***Lennart Larsson.*** *Arkiv för Kemi*, v. 13, no. 3, 1958, p. 259-268.

2670* 3-Substituted Thiophenes. Metalation of Methyl 3-Thienyl Sulphide and Methyl 3-Thienyl Sulphone. ***Salo Gronowitz.*** *Arkiv för Kemi*, v. 13, no. 3, 1958, p. 269-278.

2671 The Reaction of 2,2-Diphenyl-1-Picrylhydrazyl With Secondary Amines. ***J. E. Hazell and K. E. Russell.*** *Canadian Journal of Chemistry*, v. 36, Dec. 1958, p. 1729-1734.

2672 The Synthesis of Substituted Terphenyls. General methods of synthesis, methods based on dehydrogenations, and syntheses from other terphenyls. ***G. R. Ames.*** *Chemical Reviews*, v. 58, no. 5, Oct. 1958, p. 895-923.

2673 The Reactions of Ozone With Organic Compounds. ***Philip S. Bailey.*** *Chemical Reviews*, v. 58, no. 5, Oct. 1958, p. 925-1010.

2674 Reactions of Boron Trichloride With Organic Compounds. A review of the reactions of BCl_3 with the simpler mono-functional organic compounds. ***W. Gerrard and M. F. Lappert.*** *Chemical Reviews*, v. 58, no. 6, Dec. 1958, p. 1081-1111.

2675 Pyrroles and Related Compounds. I. Syntheses of Some Unsymmetrical Pyrrolylmethylpyrroles (Pyrromethanes). Synthesis from 5-bromomethylpyrroles and pyrrole-2-carboxylic acids by two methods. ***A. Hayes, G. W. Kenner, and N. R. Williams.*** *Chemical Society, Journal*, 1958, Nov., p. 3779-3788.

2676 Cyclic Diarsines. V. Diphenyl Derivatives Containing Seven-, Eight-, Nine-, and Ten-Membered Diarsine Ring Systems. ***Harry Heaney, Denys M. Heinekey, Frederick G. Mann, and Ian T. Millar.*** *Chemical Society, Journal*, 1958, Nov., p. 3838-3844.

2677 The Effect of the Nitro-Group on the Reactivity of the Diphenyl Nucleus in Nitration. Competitive Nitration of Nitrodiphenyls and Benzene by Nitric Acid in Acetic Anhydride. Performed at zero C. ***Y. Mizuno and O. Simamura.*** *Chemical Society, Journal*, 1958, Nov., p. 3875-3879.

2678 Synthesis of the 3-2′-Aminopropyl- and 3-2′-Aminobutyl-Derivatives of 5-Hydroxyindole, and an Alternative Synthesis of 5-Hydroxytryptamine. 5-Benzyloxy-3-formylindole, prepared from 5-benzyloxyindole, was condensed with nitromethane, nitroethane, and 1-nitropropane to give the respective 5-benzyloxy-3-2′-nitroalkenylindoles. ***A. S. F. Ash and W. R. Wragg.*** *Chemical Society, Journal*, 1958, Nov., p. 3887-3892.

2679 Studies of Trifluoroacetic Acid. XVI. The Use of 1:3-2:4-Di-*O*-ethylidene-6-*O*-trifluoroacetyl-D-glucitol in the Synthesis of Some 5- and 6-Substituted *D*-Glucitols. ***E. J. Bourne, C. E. M. Tatlow, J. C. Tatlow, and R. Worrall.*** *Chemical Society, Journal*, 1958, Nov., p. 3945-3950.

2680 The Condensation of 4:5-Diaminopyrimidines and Sugar Lactones. ***R. Hull.*** *Chemical Society, Journal*, 1958, Nov., p. 4069-4073.

2681 Organophosphorus Compounds of Sulphur and Selenium. X. Action of Sulphuryl Chloride on Alkyl Hydrogen Alkylphosphonothioates and Dialkylphosphinothioic Acids. Synthesis of *P*-Alkoxy-*P*-alkyloxophosphoranesulphenyl Chlorides. ***Cz. Borecki, J. Michalski, and St. Musierowicz.*** *Chemical Society, Journal*, 1958, Nov., p. 4081-4085.

2682 Thiophen Derivatives. XIII. Some Reactions of 3-Methylthiophen. 3-Methylthiophen is the most accessible source for many 3-substituted thiophens. ***J. Lamy, Denise Lavit, and Ng. Ph. Buu-Hoï.*** *Chemical Society, Journal*, 1958, Nov., p. 4202-4205.

2683* Reaction of Troponoids and Organometallic Compounds. III. Synthesis and Reaction of 2,7- and 2,3-Diphenyltropone. ***Toshio Mukai.*** *Chemical Society of Japan, Bulletin*, v. 31, no. 7, Oct. 1958, p. 852-857.

2684 Reactions of Acetylation. VIII. Reactions of Monosubstituted Acetylene Compounds With Quinones. The addition of monosubstituted acetylene compounds to *p*-benzoquinone and polynuclear quinones by means of Li salts of the acetylene derivatives in liquid ammonia or absolute toluol leads, according to the testing conditions, to monoquinols or diquinols, which rearrange easily in an acid medium. ***Walter Ried and Adam Urschel.*** *Chemische Berichte*, v. 91, no. 11, 1958, p. 2459-2471.

2685 Chemical Synthesis of a 1:3-α-Glucosidic Linkage. A satisfactory chemical synthesis of 3-*O*-α-D-glucopyranosyl-D-glucose has been achieved by application of the Königs-Knorr reaction. ***Kazuo Matsuda.*** *Chemistry & Industry*, 1958, no. 49, Dec. 6, p. 1627.

2686* Possibilities of a Method to Prepare α-Aminoepoxides. The reaction between a hemiacetal, α-hydroxytetrahydropyran, and several types of amines is considered. (*In*

French.) Les possibilités d'une méthode de préparation d'amino-époxydes. ***Charles Glacet and Francine Blanchard-Bielli.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 247, no. 18, Nov. 3, 1958, p. 1467-1470.

2687* Pyridines With Acetylene Function. 4-Picolyllithium prepared with methyllithium reacts normally with the alkyne halides, leading to pyridines with a true acetylene chain in the 4th position. Hydrogenation, hydration of the triple bond, and the Mannich reaction were studied. (*In French.*) Sur les pyridines à fonction acétylénique. ***Marcel Miocque.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 247, no. 18, Nov. 3, 1958, p. 1470-1472.

2688* Some Conjugate Diene Compounds Derived From Citral. Study of the Reaction of Reformatsky. Study of the Reformatsky reaction from a new viewpoint. (*In French.*) Sur quelques composés diéniques conjugués dérivés du citral. Étude de la réaction de Reformatsky. ***Max Mousseron and Magdeleine Mousseron-Canet.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 247, no. 22, Dec. 1, 1958, p. 1937-1942.

2689* Studies on the Production of Terephthalic Acid. II. Liquid Phase Air-Oxidation of *p*-Xylene Under Pressure and Liquid Phase Air-Oxidation of Methyl *p*-Toluate. (*In Japanese.*) ***Nobuto Ohta and Takashi Tezuka.*** *Government Chemical Industrial Research Institute, Tokyo, Reports*, v. 53, Aug. 1958, p. 271-276.

2690 Insecticide Preparation and Properties. Chemistry and Toxicological Properties of *O,O*-Diethyl-*O*-(2-isopropyl-4-methyl-6-pyrimidinyl) Phosphorothioate (Diazinon). ***Hans Gysin and Alfred Margot.*** *Journal of Agriculture and Food Chemistry*, v. 6, Dec. 1958, p. 900-903.

2691 Vapour Phase Hydrogenation of Furfural. Optimum conditions for the hydrogenation of furfural to furfuryl alcohol using copper chromite catalyst have been determined. Yields of about 92% furfuryl alcohol are obtained at *c.* 140 C while at higher temperature the formation of methyl furan is favored; a higher ratio of H to furfural favors the formation of furfuryl alcohol. ***Kanti Kathpalia and R. T. Thampy.*** *Journal of Scientific & Industrial Research*, v. 17A, Oct. 1958, p. 418-420.

2692 Preparation of Acetophenone & Substituted Acetophenones. A modified method is described for the preparation of acetophenone, *p*-nitroacetophenone, and other substituted acetophenones by the condensation of acetylacetone with appropriate acyl chlorides in the presence of anhydrous NaOH, alkali metal carbonates, alkali metal alkoxides, or metallic Na in non-polar solvent. ***S. S. Sabnis, K. D. Kulkarni, and C. V. Deliwala.*** *Journal of Scientific & Industrial Research*, v. 17A, Oct. 1958, p. 421-424.

2693 Anthoxanthins. VIII. Synthesis of Dihydrorobinetin Tetramethyl Ether & Its Conversion to the Corresponding Leucoanthocyanidin. ***V. R. Shah and A. B. Kulkarni.*** *Journal of Scientific & Industrial Research*, v. 17B, Oct. 1958, p. 420-422.

2694* Chemical Wealth From Sugar. A discussion of sucrochemicals. ***E. T. Dewar.*** *Manufacturing Chemist*, v. 29, Nov. 1958, p. 458-461.

2695* On the Chlorination of Phenol in the Presence of Tellurium and Its Compounds. The catalytic activity of Te and its compounds ($TeCl_4$, $H_2TeO_4 \cdot 2H_2O$, and K_2TeO_3) in the phenol chlorination reaction was established. (*In Polish.*) O chlorowaniu fenolu w obecności telluru i jego związków. ***Włodzimierz Rodziewicz, Jan Dobrowolski, and Wiesław Wojnowski.*** *Przemysł Chemiczny*, v. 37, no. 10, Oct. 1958, p. 645-648.

2696* Studies on the Chemical Reactivity of Organic Phosphorus Compounds. ***Lennart Larsson.*** *Svensk Kemisk Tidskrift*, v. 70, no. 10, 1958, p. 405-427.

2697* A Contribution to the Study of the Sesquiterpene Compounds. II. Study of the Structure of B'*cyclo*vetivenol and Tri*cyclo*vetivenol, Primary Alcohols of the Essence of Vetiver. (*In French.*) Contribution à l'étude des composés sesquitérpeniques. II. Étude de la structure du bi*cyclo*vétivénol et du tri*cyclo*vetivénol, alcools primaires de l'essence de vetiver. ***G. Chiurdoglu and J. Decot.*** *Tetrahedron*, v. 4, nos. 1/2, Oct. 1958, p. 1-16.

2698* Synthesis of Herbicides. I. Acid Phthalate Ethers of Aryloxyethanols. Synthesis of a series of these ethers for investigation of their herbicidal activity. Studying the properties of synthesized ethers and some of their Na salts. (*In Russian.*) Sintez gerbitsidov. I. Kislye ftalevokislye efiry ariloksietanolov. ***S. I. Burmistrov and O. Kh. Vlasova.*** *Ukrainskiĭ Khimicheskiĭ Zhurnal*, v. 4, no. 5, 1958, p. 629-631.

2699* The Wittig Reaction. Synthesis of olefines and unsaturated compounds with other functional groups. (*In Polish.*) Reakcja Wittiga. ***Krzysztof Kostka.*** *Wiadomści Chemiczne*, v. 12, Sept. 1958, p. 521-534.

2700* Synthesis of Aliphatic β-Vinyl Chloride Ketones From Oxymethylene Ketones. Two examples of synthesis of β-vinyl chloride ketones by the method of processing corresponding oxymethylene ketones with thionyl chloride. The examples show the possible applicability of this method also in aliphatic series. The α-alkyl-β-vinyl chloride ketones unobtainable before can be obtained by this method. (*In Russian.*) Sintez alifaticheskikh β-khlorvinilketonov iz oksimetilenketonov. ***N. K. Kochetkov, Ivan Ambrush, T. I. Ambrush, and E. S. Severin.*** *Zhurnal Obshcheĭ Khimiĭ*, v. 28, no. 11, Nov. 1958, p. 3024-3027.

CHEMISTRY—PHYSICAL

2701* Hydrolysis of Carboxylic Acid Esters of Thiocholine and Its Analogues I. Acid Hydrolysis. II. Alkaline Hydrolysis. ***Edith Heilbronn.*** *Acta Chemica Scandinavica*, v. 12, no. 7, 1958, p. 1481-1506.

2702* The First Step in the Swelling of Gelatin With Water. III. IV. V. The normal content of water in air dried gelatin is shown to be present as a solution of soluble gelatin. On this basis it is possible to give a detailed account of the progress of the watering of the gelatin. ***Chr. Winther.*** *Acta Chemica Scandinavica*, v. 12, no. 8, 1958, p. 1634-1656.

2703* On the Kinetics of the Decomposition of Cyanic Acid. Decomposition of cyanic acid and cyanate into NH_3 and CO_2 was investigated kinetically in dilute aqueous solution over the pH-range 0-7 and in strongly basic medium. ***Mogens Ballund Jensen.*** *Acta Chemica Scandinavica*, v. 12, no. 8, 1958, p. 1657-1670.

2704* Infrared Spectra of Organolithium Compounds. Intermolecular Lithium Bond. Investigation of infrared absorption spectra of alkyl- and aryl-type organolithium compounds. Study of spectra of methyl-, ethyl-, butyl-, dodecyl-, phenyl-, *n*- and *o*-tolyl-, and α-naphthyl-lithium. (*In Russian.*) Infrakrasnye spektry litiiorganicheskikh soedineniĭ. Mezhmolekuliarnaia litievaia sviaz'. ***A. N. Rodionov, D. N. Shigorin, T. V. Talalaeva, and K. A. Kocheshkov.*** *Akademiia Nauk SSSR, Doklady*, v. 123, no. 1, Nov.-Dec. 1958, p. 113-116.

2705 A Study of the System $Li_xMn_{(1-x)}Se$. ***W. D. Johnston and R. R. Heikes.*** *American Chemical Society, Journal*, v. 80, Nov. 20, 1958, p. 5904-5907.

2706 Kinetics of the Vanadium(II)-Vanadium(III) Isotopic Exchange Reaction. In 1.00 f $HClO_4$ and ionic strength 2.00 the rate of exchange between V^{II} and V^{III} is consistent with the law rate = $k \cdot (V^{II})(V^{III})$. At 25 C the value of k is 0.82 f^{-1} $min.^{-1}$. The experimental activation energy is 13.2 kcal./mole. ***Kotra V. Krishnamurty and Arthur C. Wahl.*** *American Chemical Society, Journal*, v. 80, Nov. 20, 1958, p. 5921-5924.

2707 The Vibrational Spectra of Trisilylamine and Trisilylamine-d_9. ***Dean W. Robinson.*** *American Chemical Society, Journal*, v. 80, Nov. 20, 1958, p. 5924-5927.

2708 The Photolyses of 2-Pentanone and 2-Pentanone-1,1,1,3,3-d_5. An investigation at long wave lengths at maximum intensity of 3.7×10^{14} quanta/cc./sec. and at short wave lengths, in the temperature range 25-83 C. In this study, ethylene was found to be, within experimental error, equal to

the acetone yield. In the experiments with the deuterated ketone, 90% of the acetone formed was acetone-d_6. Secondary reactions are discussed and certain ratios of rate constants are deduced. ***P. Ausloos and E. Murad.*** *American Chemical Society, Journal,* v. 80, Nov. 20, 1958, p. 5929-5932.

2709 Base Strengths of Cyanoamines. Substitution of aliphatic amines with cyano groups lowers their basicities. The N-cyano, α-cyano, β, γ, δ and ε-cyanoamines are weaker by approx. 13, 5.7, 3.1, 1.6, 0.8 and 0.4 *p*K units, respectively. The Δ pK_a of *n* cyanosubstituted amines = approx. *n* (single Δ *p*K). The lowered basicity appears due to the large inductive field effect of the cyano group. A spectrophotometric method was developed to determine the pK_a's of the very weak bases. Because of the wide range of pK_a's of the cyanoamines, their ease of preparation, and stability, aliphatic cyanoamines should be useful. ***George W. Stevenson and Dallas Williamson.*** *American Chemical Society, Journal,* v. 80, Nov. 20, 1958, p. 5943-5947.

2710 The Kinetics of the Triethylamine-Catalyzed Reaction of Diisocyanates With 1-Butanol in Toluene. ***John Burkus and C. F. Eckert.*** *American Chemical Society, Journal,* v. 80, Nov. 20, 1958, p. 5948-5950.

2711 The Hydrogen Bond. III. The Effect of the Size of Substituents Upon the Length of the Hydrogen Bond in Various Substituted 1,2-Diols. The bands due to free and internally bonded OH groups have been measured for various substituted ethylene glycols having the structures R_2COHCH_2-OH, *meso* and racemic $(RCHOH)_2$, and $(R_2COH)_2$ where R is methyl, ethyl, isopropyl, and *t*-butyl. ***Lester P. Kuhn.*** *American Chemical Society, Journal,* v. 80, Nov. 20, 1958, p. 5950-5954.

2712 The Carbonyl Stretching Frequencies of Certain Carboxylic Acid Derivatives. Electronegative groups attached to the O atom of carboxylic acids are shown to raise the stretching frequency of the carbonyl group from 15 to 70 $cm.^{-1}$ depending on the group. Organic derivatives of I, Hg, and Sn appear to contain highly ionic hetero atom-oxygen bonds. ***Jeremiah P. Freeman.*** *American Chemical Society, Journal,* v. 80, Nov. 20, 1958, p. 5954-5956.

2713 The Mechanistic Fate of Carbonyl Oxygen in the Rearrangement of 2-Anilino-1-Phenyl-1-Propanone. The rearrangement of 2-anilino-1-phenyl-1-propanone to give 1-anilino-1-phenyl-2-propanone is reversibly catalyzed by mild acids. Mechanisms which have been proposed to explain this rearrangement include nucleophilic ring opening of intermediates of the ethylene oxide or ethylene imine type as well as carbonyl addition–elimination processes. Results in 95% ethanol made up with water containing 1.2 atom % excess O-18 using aniline hydrobromide and pyridine hydrobromide as catalysts clearly indicate that there is no important oxygen exchange directly associated with the rearrangement. Therefore, any mechanism that is proposed must specifically provide for intramolecular migration of the carbonyl oxygen. ***K. LeRoi Nelson and Ralph L. Seefeld.*** *American Chemical Society, Journal,* v. 80, Nov. 20, 1958, p. 5957-5959.

2714 Spectral Properties of Medium- and Large-Ring Carbocyclic Compounds: α-Bromoketones, Enol Acetates and Unsaturated Ketones. A study of the spectra of medium- and large-ring carbocyclic 2-bromoketones, ketoneenol acetates and unsaturated ketones has provided interesting information concerning their stereochemistry. In particular, the infrared shifts observed for the carbonyl maximum in going from the cyclic ketone to the corresponding 2-bromoketone indicate that the average conformations of 2-bromocycloöctanone, 2-bromocyclononanone and 2-bromocyclodecanone fit a *syn*-skew model; the absence of an appreciable infrared shift for the ketone-2-bromoketone pairs having 11 through 15 members in the ring is indicative of a C-Br/C=O angle near 90°. ***Nelson J. Leonard and Frederick H. Owens.*** *American Chemical Society, Journal,* v. 80, Nov. 20, 1958, p. 6039-6045.

2715 Freezing-Point Behavior of the Ternary Reciprocal Salt Pair System Involving the Cyclohexylamine and Morpholine Salts of Stearic and Palmitic Acids. ***Robert R. Mod, Frank C. Magne, and Evald L. Skau.*** *American Oil Chemists' Society, Journal,* v. 35, Dec. 1958, p. 688-691.

2716 X-Ray Diffraction and Melting-Point Studies on Some Long-Chain Sulfur-Containing Acids. Three series of crystalline long-chain S compounds were studied, namely 11-(*n*-alkylsulfonyl)undecanoic acids; 11-(*n*-alkylsulfinyl)undecanoic acids; and 11-(*n*-alkylthio)undecanoic acids; where R is a selected alkyl group from methyl through undecyl. ***Lee P. Witnauer, David Lutz, N. H. Koenig, and Daniel Swern.*** *American Oil Chemists' Society, Journal,* v. 35, Dec. 1958, p. 699-703.

2717* Chelate Alkali Compounds in Organic Reactions. III. On the Reactivity of Ions and Ion-Pairs (Chelates) in the Methylation of Ethyl Acetoacetate. ***Arne Brändström.*** *Arkiv för Kemi,* v. 13, nos. 1-2, 1958, p. 51-58.

2718* Resolution and Configuration of 3-Thienylglycolic Acid. 3-Thienylglycolic acid has been resolved into its antipodes. Its steric relationship to mandelic acid has been established by the quasi-racemate method. ***Salo Gronowitz.*** *Arkiv för Kemi,* v. 13, no. 3, 1958, p. 231-238.

2719 Catalysis. v. VI. Alkylation, Isomerization, Polymerization, Cracking and Hydroreforming. ***Paul H. Emmett, editor.*** 706 pp. 1958. Reinhold Publishing Corp., New York. (QD501 Em64c)

2720* Kinetics of Water-Gas Conversion Reaction. Description of experimental investigations into the kinetics of the reaction as a function of the gas composition and its specific flow-rate. ***P. Bortolini.*** *Chemical Engineering Science,* v. 9, nos. 2-3, Nov. 1958, p. 135-144.

2721* Enthalpy-Concentration Diagram for the System Hydrogen Peroxide-Water at 50 mm Hg Total Pressure. ***P. S. Murti.*** *Chemical Engineering Science,* v. 9, nos. 2-3, Nov. 1958, p. 164-169.

2722 Adsorption on Oxide Gels From Binary Liquid Mixtures: Some Activity Coefficients of Materials at Surfaces. The nature of adsorption is controlled mainly by the polar nature of the adsorbents, the gels being very similar to one another. As compared with carbon adsorbents they show a much greater discrimination between polar and non-polar liquids. ***J. J. Kipling and D. B. Peakall.*** *Chemical Society, Journal,* 1958, Nov., p. 3899-3903.

2723 The Conductivity of Silver Salts in Non-Aqueous and Mixed Solvents. VII. The conductivity of $AgNO_3$ in benzonitrile and in benzonitrile solutions containing ethanol and of $AgClO_4$ in pure and binary mixtures of acetone, cyclohexanone, and isobutyl alcohol. ***V. S. Griffiths, K. S. Lawrence, and M. L. Pearce.*** *Chemical Society, Journal,* 1958, Nov., p. 3998-4001.

2724 Effect of Various Anions on Thickness and Active-Oxygen Content of Nickel Oxide Layers Formed by Repeated Anodic-Cathodic Cycling; the Specific Effect of Chloride Ions and Its Dependence on the Nature of the Substrate. Studies the effect of the fluoride, nitrate, perchlorate, and chloride anions on Ni and Pt substrates in a bath of a Ni salt. ***H. K. Embaby and A. A. Moussa.*** *Chemical Society, Journal,* 1958, Nov., p. 4027-4031.

2725* Studies on the Interaction of Surface Films With Solute in Solution. I. Potentiometric Titration of Aqueous Dye Solution and Calculation of Ionization Constant of Dye. II. Sorption of Dye on the Built-up Film of Stearic Acid and Barium Stearate. III. Effect of Dissolved Dyes Upon the Monolayer of Octadecylamine. ***Mitsuo Muramatsu.*** *Chemical Society of Japan, Bulletin,* v. 31, no. 7, Oct. 1958, p. 864-882.

2726 The Ultra-Violet Spectrum of Silicon Difluoride. Ultra-violet bands in the region 2200 to 2500 Å observed in emission from a discharge excited by a radio-frequency oscillator in the vapor of SiF_4 are ascribed to the difluoride, SiF_2. Two vibrational intervals, at 937 and 427 cm^{-1}, are characteristic of the transition. ***J. W. C. Johns, G. W. Chantry, and R. F. Barrow.*** *Faraday Society, Transactions,* v. 54, Nov. 1958, p. 1589-1591 + 1 plate.

2727 The Dissociation Energy of Fluorine. The analysis of published measurements of the pressure in partly dissociated fluorine gas leads to the value D_{298} (F_2) = 37.72 ± 0.13 kcal/

mole. The electron affinity of fluorine at 298 K is $83.4_1 \pm 2.5_6$ kcal/g atom. ***J. G. Stamper and R. F. Barrow.*** *Faraday Society, Transactions*, v. 54, Nov. 1958, p. 1592-1594.

2728 Primary Photochemical Processes in Aromatic Molecules. IV. Side-Chain Photolysis in Rigid Media. Two processes of side-chain fission have been identified in the photolysis of substituted aromatic molecules in rigid solvents at low temperatures. One involves fission of a β bond to yield two radicals and the other results directly in the formation of two molecules, one of which is styrene. Quantum yields at 2537 Å in one example of each process, were 1.1×10^{-5} and 3.6×10^{-2} respectively. ***G. Porter and E. Strachan.*** *Faraday Society, Transactions*, v. 54, Nov. 1958, p. 1595-1604 + 1 plate.

2729 Magnetic Perturbation of Triplet Transitions. In chloroform solution, naphthalene, anthracene, phenanthrene, and pyrene have been found to show a number of absorption bands in the visible region in presence of acetylacetonates of Cu and Fe, but not of Al. The longest wavelength band in each case was found to correspond with the shortest singlet-triplet emission band in the phosphorescence spectra of the respective compound. By analogy with the absorption bands noticed with hydrocarbon solutions in presence of O_2 and NO by Evans, the absorption bands observed in the present case have been attributed to single-triplet absorption due to magnetic perturbation by metal chelates. ***Jayanti Nag Chaudhuri and Sadhan Basu.*** *Faraday Society, Transactions*, v. 54, Nov. 1958, p. 1605-1608.

2730 Diamagnetism of Substituted Coumarins and the Reactivity of Coumarin Nucleus. In general the susceptibilities of the 7-hydroxy substituted coumarins are higher than those of the corresponding 6-isomers. The λ values for substituted coumarins are positive or negative according as the substituent is an *o*-, *p*- or *m*-directing group, and their magnitude increases with the increase in the number of groups. A parallelism has been found between the electron densities of C atoms in various positions in the ring, and the reactivity of the coumarin molecule. ***R. M. Mathur.*** *Faraday Society, Transactions*, v. 54, Nov. 1958, p. 1609-1612.

2731 The Second Virial Coefficients of Pyridine and Benzene and Some Methyl Homologues Between 135° and 165°C. The second virial coefficients of pyridine, α-, β-, and γ-picoline, 2:6-lutidine, benzene, toluene, *o*-, *m*-, and *p*-xylene have been determined from vapor compressibility measurements at 135.8, 151.0, and 164.6 C. The values are combined with earlier measurements to yield equations for the temperature dependence of the second virial coefficients of these compounds. ***J. D. Cox and R. J. L. Andon.*** *Faraday Society, Transactions*, v. 54, Nov. 1958, p. 1622-1629.

2732* Equilibrium Distribution of Dissolved Sulphur Species in Water at 25°C and 1 Atm Total Pressure. The E_h-pH diagrams for the equilibrium concentrations in aqueous solution of native S and all the various S-containing ions and acids from which the ions are produced have been constructed for systems having a total S concentration of 0.1 molar. ***R. M. Garrels and C. R. Naeser.*** *Geochimica et Cosmochimica Acta*, v. 15, nos. 1-2, Nov. 1958, p. 113-130.

2733 Redox Potentials and Their Uses. A semiquantitative approach to the ways in which potential data can be applied. ***J. E. Spice.*** *Industrial Chemist*, v. 34, Dec. 1958, p. 661-670.

2734 The Determination of Stability Constants of Complex Inorganic Species in Aqueous Solutions. Evolution of the presently used methods for determining the ionic species present in solution and for obtaining the equilibrium constants for their formation. ***Stuart Tobias.*** *Journal of Chemical Education*, v. 35, Dec. 1958, p. 592-599.

2735 Self-Diffusion in Argon to 300 Atmospheres. The coefficient of self-diffusion for Ar is measured from 68 to 291 atm. at 49.4 C. A radioactive tracer technique employing Ar^{37} is used and coefficients are measured in a cell in which the path of diffusion is through a plug of porous bronze. ***T. R. Mifflin and C. O. Bennett.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 975-978.

2736 Growth of Potassium Chloride Crystals From Aqueous Solution. It is shown that the growth behavior of KCl crystals from aqueous solution is consistent with the Frank growth mechanism. The growth behavior is altered by the presence of a few p.p.m. of $PbCl_2$. It is imputed that the rate of growth at unit steps is inhibited and that the rate of two-dimensional nucleation is markedly increased by the presence of $PbCl_2$. The effects are consistent with complete line adsorption of a complex Pb-containing ion at growth steps. ***Gerald W. Sears.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 979-983.

2737 Entropies and Energies of Dimerization of Alkali Metal Halides. Calculated entropies of dimerization for a number of gaseous alkali metal halides, assuming the rhombic planar model for the dimer, fall in the range -31.0 ± 1.5 entropy units. Entropies of dimerization deduced from experimental data for several species diverge appreciably from the calculated values. The differences can be attributed to uncertainties in the graphical determination of dimerization energies. ***S. H. Bauer, R. M. Diner, and Richard F. Porter.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 991-995.

2738 Perpendicular Bands of Allene and Allene-d_4. The distribution of intensity in the perpendicular bands of allene has been examined, taking into account the effect of the Coriolis interaction between the degenerate levels ν_9 and ν_{10}. The results indicate that in all the perpendicular bands of allene and allene-d_4 the $^RQ_0$ branch lies on a line which divides the band into two equal areas. ***John Overend and Bryce Crawford, Jr.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 1002-1011.

2739 Calculation of Nuclear Magnetic Resonance Spectra of Aromatic Hydrocarbons. C. E. Johnson, Jr. and F. A. Bovey. *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 1012-1014.

2740 Structural Isomer Discrimination Between Cyanamides and Carbodiimides by Nitrogen Nuclear Magnetic Resonance. The structural isomers diethylcyanamide and N,N′-dicyclohexylcarbodiimide were studied by both proton and nitrogen NMR techniques. The structures $R_2N\text{-}C{\equiv}N$ and $R\text{-}N{=}C{=}N\text{-}R$ have been shown to apply to cyanamides and carbodiimides, respectively. ***James D. Ray, Lawrence H. Piette, and Donald P. Hollis.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 1022-1024.

2741 Absorption Spectra in Molten Salt Solutions. The absorption spectra of solutions of alkali halides and of halogen gases in alkali halide eutectic melts are described. The spectra of the halides are interpreted as ←charge transfers from the anion. The halogens are shown to dissolve in these solvents to form trihalide ions. ***Jacob Greenberg and Benson R. Sundheim.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 1029-1032.

2742 Study of Molecular Patterns in the Field Emission Microscope. Field emission patterns of organic dye molecules such as phthalocyanine or flavanthrene show improved stability when the tip temperature is lowered. No prior contamination or buildup is necessary for the production of typical quadruplet or doublet patterns. Upon heating or ion bombardment the molecule patterns may disappear in several distinct steps of size and intensity. ***Allan J. Melmed and Erwin W. Müller.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 1037-1041.

2743 Effect of Poisons on Crystal Growth. The effect of impurities is inexplicable by the accepted theory of crystal growth. In this report a mechanism is presented which describes the specific action of crystal-growth poisons. ***Gerald W. Sears.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 1045-1048.

2744 Ion Exchange Kinetics. A Nonlinear Diffusion Problem. II. Particle Diffusion Controlled Exchange of Univalent and Bivalent Ions. The differential equation derived previously which describes the particle diffusion controlled ion exchange between spherical beads of uniform size and a well-stirred solution is solved numerically for the exchange of monovalent ions for bivalent ions, and of bivalent ions for monovalent ions. The approach is based on the Nernst-Planck equations of ionic motion. Numerical results for six different mobility ratios are presented and discussed. ***M. S. Plesset, F. Helfferich, and J. N. Franklin.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 1064-1069.

2745 Mass Spectrometric Study of the Vaporization of LiF, NaF, and LiF-NaF Mixtures. Vapors effusing from Knudsen cells containing LiF, NaF, and LiF-NaF mixtures have been analyzed mass spectrometrically. The over-all temperature range studied is between 900 and 1150 K. Monomers, dimers, and trimers of LiF and NaF are observed. The LiF system has the higher concentration of dimers and trimers. ***Richard F. Porter and Richard C. Schoonmaker.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 1070-1074.

2746 Small Perturbations in Solution Theory. A general perturbation theory is developed for the solution properties of systems with comparable intermolecular interactions. ***Frank P. Buff and Fred M. Schindler.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 1075-1081.

2747 Calculation of the Radial Distribution Function From the Cell Theory of Liquids. A method is given for determining the radial distribution function from the cell theory of liquids. The application of the scheme is demonstrated for two simple choices of the cell distribution function. This technique should prove useful in correlating the observed structure of the radial distribution function with molecular ordering in liquids and in establishing the limitations of the cell model. ***John S. Dahler.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 1082-1085.

2748 Small-Angle X-Ray Scattering From Solutions of Aerosol OT in Nonaqueous Media. The small-angle scattering of solutions of di(2-ethylhexyl) sodium sulfosuccinate in *n*-dodecane has been investigated for the concentration range 6%-75%. ***L. A. Siegel.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 1091-1096.

2749 Ligand Field Theory of Ni(II) Complexes. III. Electronic Spectra and Solution Paramagnetism of Some Diamagnetic Ni(II) Complexes. The observed electronic absorption spectra of six diamagnetic Ni chelates are successfully assigned using ligand field theory with consistent values of the field parameters. ***Gilda Maki.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 1129-1138.

2750 Properties of Hydrogen Chemisorbed on Tungsten. The sticking probability of H on a single crystal W ribbon was measured as a function of the number of adsorbed atoms. The work function of the same ribbon was measured by a photoelectric technique. The results indicate that during the initial fast chemisorption characterized by an almost constant sticking probability of approximately 0.2 the work function rose from 4.54 ev for the clean surface to a maximum value of 5.0 ev for the covered surface. ***Joseph Eisinger.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 1154-1160.

2751 Semiempirical Calculation on the Electronic Structure of the Nitrogen-Containing Heterocyclic Molecules. I. General Theory. A semiempirical theory for n-π and π-π spectra of nitrogen heterocycles is proposed. The theory is an extension of the semi-empirical molecular-orbital method of Pariser and Parr, and the nonbonding electrons localized at the N atoms as well as π electrons are considered explicitly into the interaction term in the Hamiltonian. The orbitals in which nonbonding electrons are contained may be any $2s$-$2p$ hybrids. I. ***Tosinobu Anno.*** II. ***Tosinobu Anno and Akira Sado.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 1161-1173.

2752 The Stability Constants, Solubilities and Solubility Products of Complexes of Copper With Dialkyldithiocarbamic Acids. ***Matthijs J. Janssen.*** *Journal of Inorganic and Nuclear Chemistry*, v. 8, 1958, p. 340-345.

2753* Infrared Spectra and Structure of Some Derivatives of Formhydroxamic Acid. I. O-Methyl Formhydroxamic Acid. ***A. E. Parsons.*** *Journal of Molecular Spectroscopy*, v. 2, no. 6, Dec. 1958, p. 566-574.

2754* The Infra-Red Spectra of Some Ferroelectric Compounds With Short Hydrogen Bonds. ***R. Blinc and D. Hadži.*** *Molecular Physics*, v. 1, no. 4, Oct. 1958, p. 391-405.

2755* On the Limit of Superheat. A new method of observing the limit of superheat was devised, in which small drops of a sample liquid are heated as they rise in the nonsoluble heating liquid with a suitable temperature gradient upward. The limit of superheat was determined, mainly for some saturated hydrocarbons and polymethylenes. The result was compared with Döring's theory of spontaneous bubble formation in superheated liquids. The agreement between the theory and experiment was satisfactory, which seems to throw some light upon the problem of surface free energy on the nuclear bubble. ***Hiromu Wakeshima and Kazuo Takata.*** *Physical Society of Japan, Journal*, v. 13, Nov. 1958, p. 1398-1403.

2756* Detergent Adsorption on Soil and Substrate. II. A discussion of surface area measurements on various types of molecules. ***Jay C. Harris.*** *Soap and Chemical Specialties*, v. 34, Dec. 1958, p. 59 + 4 pages.

2757* Some Aspects of the Thermochemistry and Thermodynamics of Fluorocarbons. The thermochemistry of some simple fluoro-compounds is discussed, and it is shown that the heats of formation of tetrafluoroethylene and of some 1:1-difluoroethylenes are anomalously low, suggesting a weakening of the double bond in these compounds as compared with that in more familiar ethylenes. This fact is shown to account for the high thermal stability of octafluoro*cyclo*butane and of polytetrafluoroethylene. ***C. R. Patrick.*** *Tetrahedron*, v. 4, nos. 1/2, Oct. 1958, p. 26-35.

2758* Symmetry and Number of the Rotation Isomers of Unbranched Polymethyl Chains. On the basis of three fixed arrangements of each C-C axis in polymethyl compounds $X\text{-}(CH_2)_n\text{-}X$, the symmetry properties of all possible rotation isomers were studied and formulas were devised for the number of spectroscopically different rotation isomers of each point group found. (*In German.*) Symmetrie und Anzahl der Rotationsisomeren von unverzweigten Polymethylenketten. ***Ernst Funck.*** *Zeitschrift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie*, v. 62, no. 8, 1958, p. 901-905.

2759* Electrochemical Reduction of Nitrosamine. Polarographic and potentiostatic investigation of a large number of nitrosamines in a wide *p*H range. Interpretation of some peculiarities in their behavior by assuming a prearranged dissociation equilibrium. Reduction on a large surface Hg cathode. General reduction scheme. (*In German.*) Zur elektrochemischen Reduktion der Nitrosamine. ***Ludwig Holleck and Ralph Schindler.*** *Zeitschrift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie*, v. 62, no. 9, 1958, p. 942-947.

2760* Zinc Diethyl as Solvent. I. Physical and Chemical Properties. II. Investigations of Conductivity. (*In German.*) Über Zinkdiäthyl als Lösungsmittel. I. Physikalische und chemische Eigenschaften. II. Leitfähigkeitsuntersuchungen. ***G. Jander and L. Fischer.*** *Zeitschrift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie*, v. 62, no. 9, 1958, p. 965-977.

2761* Infra-Red Spectra of Some 4,4′ Derivatives of Azobenzene and Azoxybenzene. Infra-red spectra, within a 1 to 15μ range, of 4,4′-dimethoxy-azobenzene and -azoxybenzene, of 4,4′-dihalide-azobenzenes and -azoxybenzenes, of 4,4′-dimethylmercapto azoxybenzene, and of 4,4′-diethyl-azobenzene in the solid phase and in solution in CS_2 and C_2Cl_4. (*In German.*) Die Infrarotspektren einiger 4,4′ -Derivate des Azobenzols und Azoxybenzols. ***Wilhelm Maier and Gerhard Englert.*** *Zeitschrift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie*, v. 62, no. 9, 1958, p. 1020-1032.

2762* Spectroscopic Investigations of Silicon Compounds. III. Vibration Spectra of the Derivatives $(CH_3)_2SiX_2$. Raman and IR spectra of $(CH_3)_2SiH_2$, $(CH_3)_2SiF_2$, and $(CH_3)_2SiBr_2$. Rate of the individual vibration forms. The internal vibrations of the CH_3 groups in all molecules are rather constant. Some differences in $(CH_3)_2SiH_2$ are discussed. (*In German.*) Spektroskopische Untersuchungen an Siliciumverbindungen. III. Die Schwingungsspektren der Derivate $(CH_3)_2SiX_2$. ***Heinrich Kriegsmann.*** *Zeitschrift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie*, v. 62, no. 9, 1958, p. 1033-1037.

2763* An I.R. Spectroscopic Study of the Components of the Ziegler Catalyst System $TiCl_4$ + $Al(CH_3)_2Cl$. ***M. P.***

Groenewege. Zeitschrift für Physikalische Chemie (Neue Folge), v. 18, nos. 3/4, Nov. 1958, p. 147-162.

2764* Thermographical Investigation of Regeneration Processes of Chromium Catalysts. Study of carbon poisoning of Cr catalysts; the effect of temperature and time of operation on formation of the double carbon layer. (*In Russian.*) Termograficheskoe issledovanie protsessov regeneratsii khromovykh katalizatorov. ***T. V. Rode and A. A. Balandin.*** *Zhurnal Obshchei Khimii*, v. 28, no. 11, Nov. 1958, p. 2909-2915.

See also: **2533** (systems KF-UF_4 and RbF-UF_4); **2565** (non-homogeneous chromatographic columns).

COATINGS

2765* The Formulation of Aerosol Alkyd Enamels. By applying given general principles to aerosol paint formulation studies, it is possible to prepare a formulation with the assurance that the best selection of components has been made. ***Frank A. Bower.*** *Aerosol Age*, v. 3, Dec. 1958, p. 36 + 4 pages.

2766* Petrolatum and Printing Ink. The functions of petrolatum in a formulation. ***Erich Meyer.*** *American Ink Maker*, v. 36, Dec. 1958, p. 67 + 2 pages.

2767* The Irrepressible Collapsible Metal Tube. A history of the product and of those connected with it. ***George A. Stauter.*** *American Perfumer and Aromatics*, v. 72, Dec. 1958, p. 31-43.

2768 Flame-Spraying and Sintering of Plastics. High polymers in powder or paste form may be used in flame-spraying. ***H. Schwarz.*** *British Plastics*, v. 31, Nov. 1958, p. 482-485.

2769* Thermal Insulation Ceramic Coatings. Surveys developments in coatings for aircraft engine components. Best future prospects are indicated for flame sprayed Al_2O_3 or ZrO_2, and coatings reinforced by wire mesh or ceramic fibers. ***A. V. Levy.*** *Canadian Aeronautical Journal*, v. 4, no. 10, Dec. 1958, p. 343-346.

2770* How Welding Combats Chemical Corrosion. The application of the inert-gas-shielded metal-arc process for the overlaying of mild steel digesters. ***F. Schneider and R. J. Walker.*** *Canadian Metalworking*, v. 21, Dec. 1958, p. 34 + 4 pages.

2771 Lining Technique Halves Vessel Cost. Large vessels can be lined with Hastelloy by welding and are much cheaper than solid-alloy equipment. ***J. F. De Lorenzo.*** *Chemical Engineering*, v. 65, Dec. 29, 1958, p. 70 + 2 pages.

2772 Hotter Arc Makes a Harder Coating. An arc plasma torch for coatings application; it's also being studied as a heat source for electric furnaces and high-temperature chemical reactions. *Chemical Week*, v. 83, no. 24, Dec. 13, 1958, p. 27 + 2 pages.

2773 What We Now Know About Paints. Notes from the Building Research Institute conference on field-applied paints and coatings in Washington, D. C. *Engineering News-Record*, v. 161, no. 24, Dec. 11, 1958, p. 28 + 1 page.

2774* Centrifuging Removes Excess Tinplate, Improves Finish. Removes tears and economizes on tin. *Industrial Finishing (London)*, v. 10, Dec. 1958, p. 33.

2775 Conveyor Runs Structurals Through Paint Line. Carries random sizes through paint line without need for turning or shifting. ***R. H. Eshelman.*** *Iron Age*, v. 182, no. 22, Nov. 27, 1958, p. 70-71.

2776 Flow Method Puts Quality Coat on Large Parts. Equipment can now handle vertically hung parts up to 29 ft. Horizontal units flow coat workpieces up to 60 ft. long. Flow coating is considered a high utilization method. ***E. A. Zahn.*** *Iron Age*, v. 182, no. 26, Dec. 25, 1958, p. 50-51.

2777* Plasma Gas Guns Reach 30,000°F. How the plasma gun works and what it does. ***William M. Stocker, Jr.*** *Metalworking Production*, v. 102, no. 48, Nov. 28, 1958, p. 2088-2089.

2778 Polyurethane Resins Based on Deepoxidized Epoxy Resins. For improved flexibility the most promising method consists of making adducts from deepoxidized ethoxylin resins, diisocyanates, and polyethyleneglycols in order to get modified deepoxidized ethoxylin resins presenting longer molecular chains. ***J. Poswick and C. Dramais.*** *Official Digest*, v. 30, Dec. 1958, p. 1431-1449.

2779 Less Moisture Means Faster Wax-Cake Molding. Moisture condensation on wax cakes during continuous molding operations has been eliminated by silicone coating the molding pans, preheating the pans before filling, and by minor equipment changes. ***S. F. Kandra and W. D. Manz, Jr.*** *Oil and Gas Journal*, v. 57, no. 1, Jan. 5, 1959, p. 113-115.

2780* Thermal Instability of Novolac Resins. The above, prepared by the reaction of formaldehyde with phenol in the presence of an acid catalyst, are believed to be essentially linear polymers. ***Howard E. Hoyt, H. W. Keuchel, and R. B. Dean.*** *Paint and Varnish Production*, v. 48, no. 13, Dec. 1958, p. 33-36.

2781* Acrylic Coatings From Organic Solutions. Properties and applications of these less well known coatings. ***Gerould Allyn.*** *Paint and Varnish Production*, v. 48, no. 13, Dec. 1958, p. 41 + 9 pages.

2782* Alkyds in Architectural Paints. Points out, recommends, and possibly predicts those specific areas and compositions which will use alkyd resin in present and future years. Includes formulations. ***William M. Kraft and George T. Roberts.*** *Paint Industry Magazine*, v. 73, Dec. 1958, p. 7 + 4 pages.

2783* Polyurethane Architectural Finishes. Commercial polyurethane vehicles tailored specifically for the paint industry are characterized by durability under adverse conditions such as weather, abrasion, or corrosive attack. ***R. A. Bieneman.*** *Paint Industry Magazine*, v. 73, Dec. 1958, p. 12 + 4 pages.

2784 Raft Trials of Underwater Paints. I. Methods employed at the Admiralty Dockyard, Portsmouth, for the testing of antifouling and anticorrosive coatings, are described, with an account of the site. ***J. C. Kingcome.*** *Paint Manufacture*, v. 28, Dec. 1958, p. 375 + 4 pages.

2785 Properties Required of Pigments. II. An account of requirements is given, with indications of the progress being made to meet them. ***D. M. Varley.*** *Paint Manufacture*, v. 28, Dec. 1958, p. 379 + 4 pages.

2786 Paint on the High Seas. An account of work on the improvement of antifouling and anticorrosive coatings for marine use. *Paint Manufacture*, v. 28, Dec. 1958, p. 383 + 2 pages.

2787 The Wetting and Dispersing Action of Liquids on Powders. A criterion of the degree of wetting action of a liquid for a solid (for example, a paint pigment) is given by the rheological properties of dispersions of the finely divided solid. Good wetting action is accompanied by low relative viscosity, and comparatively low rate of settling, and on the other hand poor wetting is indicated by high relative viscosity and yield value, thixotropy, and other rheological phenomena. ***E. W. J. Mardles.*** *Paint Technology*, v. 22, Oct. 1958, p. 353-356.

2788 What Electroless Nickel Can Do for You. A brief general discussion. ***Robert J. Girard.*** *Plating*, v. 45, Dec. 1958, p. 1234-1238.

2789 Non-Electric Gold Plating. Claims process is simple, inexpensive, effective. ***Harold Robinson.*** *Precision Metal Molding*, v. 16, Dec. 1958, p. 43.

2790* New Automobile Finishes—Do They Need Wax Protection? Shows the value of wax as manifested by better general appearance and reduced chalking or dulling. ***K. F. Parr and D. E. Whyte.*** *Soap and Chemical Specialties*, v. 34, Dec. 1958, p. 89 + 4 pages.

2791* Repartition and Effect of Aluminum in a Bath for Galvanizing Sheets. Effect of aluminum on the appearance, thickness, structure and adhesive strength of the zinc coat. (*In German.*) Verteilung und Wirkung von Aluminium in einem Blechverzinkungsbad. ***Rolf Haarmann and Dietrich Horstmann.*** *Stahl und Eisen*, v. 78, no. 25, Dec. 11, 1958, p. 1808-1811.

2792* Documentation and Protection Against Corrosion by Paints. Presents a significant documentation which would enable a successful comparison and interpretation of results to be given. (*In German.*) Dokumentation und Rostschutz durch Anstriche. ***K. A. van Oeteren-Panhäuser.*** *Werkstoffe und Korrosion*, v. 9, Nov. 1958, p. 681-686.

See also: **2553** (NbC coating for graphite); **3045** (coatings in space applications); **3551** (polymer chemistry of coatings); **3589** (neoprene and Hypalon coatings).

CONTROL SYSTEMS, COMPUTERS, AND SYSTEMS ENGINEERING

2793* Principal Questions of the General Theory of Automatic Control Cybernetic Systems. Analysis of the block-schemes and the equations of dynamics of cybernetic systems for the case when the controlled object has constant parameters (object with self-changing setting). All basic positions of the theory of combined automatic control systems can be applied (taking into consideration small modifications) to cybernetic systems distinguished by self-changing of characteristics. The cybernetic systems can work with a very high gain factor, several times higher than the value obtained from the stability conditions. (*In Ukrainian.*) Osnovni pitannia zagal'noi teorii kibernetichnikh sistem avtomatichnogo upravlinnia. ***O. G. Ivakhnenko.*** *Avtomatika*, 1958, no. 3, p. 1-21.

2794* Analysis of Optimalizing Control Systems by Investigation of Their Transient Response Processes. Investigation of direct sensitivity type controllers by means of (1) reducing the system of differential equations to a linear differential equation, (2) the phase plan method, and (3) the Kryloff-Bogoliouboff method. Investigations are conducted on systems both with symmetrical and asymmetrical characteristics of the controlled object. (*In Ukrainian.*) Analiz sistem ekstremal'nogo reguliuvannia za dopomogoiu doslidzhennia perekhidnikh protsesiv u nikh. ***O. M. Krizhanovs'kii and V. M. Kuntsevich.*** *Avtomatika*, 1958, no. 3, p. 23-42.

2795* Improvement of the Operation of Servosystems by Means of a Non-Linear Correcting Network. (*In Ukrainian.*) Polipshennia roboti sliduiuchoi sistemi za dopomogoiu neliniinogo korektuiuchogo pristroiu. ***B. Iu. Mandrovs'kii-Sokolov.*** *Avtomatika*, 1958, no. 3, p. 44-50.

2796* Investigation of Slowly Damping Transitional Processes in Non-Linear Systems. The developed method can be applied also for calculation of the most advantageous parameters of automatic controllers with several non-linear characteristics, and for rapidly damping and aperiodic transitional processes. (*In Ukrainian.*) Doslidzhennia povil'no zatukhaiuchikh perekhidnikh protsesiv u neliniinikh sistemakh. ***I. I. Krinets'kii.*** *Avtomatika*, 1958, no. 3, p. 52-61.

2797* Difference Theory of Automatic Instruments for Path Recording. Study of principal instrumental errors. Precise theory of instruments applying difference dependences between car position coordinates in location points of adjoining wheels, which is free from errors of principle. (*In Ukrainian.*) Riznitseva teoriia avtomatichnikh priladiv dlia zapisu proidenogo shliakhu. ***I. I. Langenbakh.*** *Avtomatika*, 1958, no. 3, p. 63-73.

2798 Application of Shift Register Techniques to Materials Handling. Circuit configurations and field applications are described for dispatching, scanning, counting, and static stepping switch functions. ***H. C. Diener, Jr.*** *Electrical Engineering*, v. 78, Jan. 1959, p. 69-73.

2799 Perforated Storage Media. Applications include communications systems, office equipment, computers, numerical machine controls, typesetters and automatic testers. Thirty-two systems are described. ***H. L. Tholstrup.*** *Electrical Manufacturing*, v. 62, Dec. 1958, p. 53 + 9 pages.

2800 Ferroelectric Storage Devices. Storage properties of ferroelectric materials, particularly with reference to barium titanate single crystal capacitors were investigated. Switching characteristics and other relevant factors were examined. ***S. Morleigh.*** *Electronic Engineering*, v. 30, Dec. 1958, p. 678-684.

2801 A Track Switching System for a Magnetic Drum Memory. . . . using a rectifier function mesh, and magnetic gating transformers is described. ***D. D. Majumder.*** *Electronic Engineering*, v. 30, Dec. 1958, p. 702-705.

2802 The Effects of Random Factors in Control-System Design. ***Albert B. Bishop.*** *News in Engineering at Ohio State University*, v. 30, no. 4, Nov. 1958, p. 25-28.

2803* Proposal for an Analog-to-Digital Electronic Converter Suited for Nuclear Pulse Height Analysis. An analog-to-digital converter is proposed based on the use of delay lines as codifying elements. Application of the converter to pulse height analyzers, with one or more channels, is discussed. Preliminary experimental work is briefly reported. ***A. Alberigi, C. Bernardini, and I. F. Quercia.*** *Nuclear Instruments*, v. 3, no. 4, Oct. 1958, p. 201-203.

2804* A Simplified Theory of Feedback Control Systems, VI. ***P. Naslin.*** *Process Control and Automation*, v. 5, Dec. 1958, p. 519-522.

2805* State of the Art: Inertial Guidance. A brief review of space-fixed and precessed gyro guidance systems suited to ballistic missile needs. ***W. G. Wing.*** *Space/Aeronautics*, v. 31, no. 1, Jan. 1959, p. 24 + 6 pages.

2806* State of the Art: Infrared. This article briefly reviews rapid-scan detectors for better recon, discusses use of thermopause region of spectrum, and stresses the need for adequate radiation data. ***Raymond H. McFee.*** *Space/Aeronautics*, v. 31, no. 1, Jan. 1959, p. 26 + 6 pages.

2807* Synthesis of Sampled-Data Servo Systems by Z-Transform Techniques. This paper describes the Z transform and its application to system analysis, and gives an example of its use in the analysis of nonlinear systems. ***Solomon A. Zadoff and Oscar Lowenschuss.*** *Sperry Engineering Review*, v. 11, no. 4, Dec. 1958, p. 41-45.

See also: **2454** (missile control equipment); **2822** (analog computer applied to diffusion processes); **3241** (electrical controls in aluminum plants); **3633** (automatic gas-shielding in arc welding); **3640** (remote control of arc welding); **3648** (electronic spot-welding controls).

ELECTRICAL ENGINEERING

2808 Measurement of the Dielectric Properties of Low Loss Materials at Millimeter Wavelengths. Measurement of the properties of low loss materials by a free space technique is described. The dielectric constant is determined from the Brewster angle, and the dielectric loss tangent from the attenuation coefficient measured at the Brewster angle of incidence. Results are given for bakelite at wavelengths between 5 and 10 mm. ***A. G. Mungall.*** *Canadian Journal of Physics*, v. 36, Dec. 1958, p. 1672-1677.

2809* Power in Russia. Three papers comparing Russian electric utilities with those of the U. S. ***Walker L. Cisler, Elmer L. Lindseth, and Edwin Vennard.*** *Edison Electric Institute Bulletin*, v. 26, Dec. 1958, p. 371 + 6 pages.

2810 Techniques of Cooling Electronic Equipment. II. Deals with various cooling methods as applied to specific electronic parts and equipment. ***James P. Welsh.*** *Electrical Manufacturing*, v. 62, Dec. 1958, p. 87 + 10 pages.

2811 Backlash in Servo Systems. Backlash can be so damaging to the proper operation of the system that it malfunctions. The frequency response approach appears to be the most satisfactory procedure for analysis. ***R. V. Halstenberg and Paul E. Russell.*** *Electrical Manufacturing*, v. 62, Dec. 1958, p. 96 + 6 pages.

2812 Volt-Ampere Graphical Analysis. This system is of deceptive simplicity when applied to linear circuits. When applied to non-linearities, however, this simplicity permits obtaining an evaluation more easily than by any other process. ***Vincent J. Petrucelly.*** *Electrical Manufacturing*, v. 62, Dec. 1958, p. 104-109.

See also: **2576** (antistatic agents for oil products); **2883** (power station costs); **3251** (properties of aluminum alloy power cables); **3649** (control of arc-welding transformers).

ELECTROCHEMISTRY

2813 Review of French Anodising Patents. ***V. F. Henley.*** *Light Metals*, v. 21, Dec. 1958, p. 387-388.

2814* Investigations Concerning the Deposition of Electrolytic Metal Coatings. Tests revealed defective convection of the cyanide copper bath used with profiled articles having an angle opening less than 6 mm. With a 6 mm. opening and a depth of profile equal to or larger than 6 mm., stirring the bath does not improve copper plating as compared with nickel plating. Partially replacing nickel plating by preliminary cyanide copper plating does not improve the all over distribution of the coatings. (*In German.*) Untersuchungen über die Verteilung galvanischer Metallauflagen. ***E. Raub.*** *Metalloberfläche*, v. 12, Dec. 1958, p. 353-360.

2815 The Chemistry of Bright Nickel Plating Solutions. Second class brighteners make it possible to build mirror-brightness, but yield brittle, stressed deposits of poor appearance, and are intolerant to impurities in the plating solution. These objections are overcome by adding brighteners of the first class as well. ***Edward B. Saubestre.*** *Plating*, v. 45, Dec. 1958, p. 1219-1227.

2816* Investigation of Electrolytic Deposition of Cobalt—Tungsten Alloys. (*In Russian.*) Issledovanie Elektroosazhdeniia Splavov Kobal't-Vol'fram. ***A. I. Zaiats and T. F. Frantsevich-Zabludovskaia.*** *Ukrainskii Khimicheskii Zhurnal*, v. 24, no. 5, 1958, p. 585-591.

ELECTRONICS

2817 Advances in Electronics and Electron Physics. The subjects considered in the book include: an analysis of three distinct kinds of nonuniform d.c. electron flow in magnetically focused cylindrical beams; the defects in diamond-type semiconductor crystals; the connection between optics and microwaves and the summary of the present position in the development of optical-type microwave instruments; a summary of developments in computer logical organization; the reliability problems associated with small receiving-type tubes; and the recent oscilloscope developments. ***L. Marton and Claire Marton, editors.*** v. X. 320 pp. 1958. Academic Press, New York. (TK161 A95e Vis.)

2818 Transistor Voltage Regulators. ***G. W. Meszaros.*** *Bell Laboratories Record*, v. 36, Dec. 1958, p. 442-445.

2819 An Experimental Gas Diode Switch. ***A. D. White.*** *Bell Laboratories Record*, v. 36, Dec. 1958, p. 446-449.

2820 New Broad-Band Oscilloscope Tube. The tube can handle signals up to 500 mc, has a trace width of 0.01 inch and requires 50 millivolts on the 76 ohm input line to deflect the beam by one trace width; 0.4 milliwatt RF power is required to produce a peak-to-peak deflection of 10 trace widths. The vertical deflection system consists of a helix wound of flat tape. ***D. J. Brangaccio.*** *Bell Laboratories Record*, v. 36, Dec. 1958, p. 450-452.

2821 The Silicon Controlled Rectifier—A Semiconductor Power Switch With Microsecond Response. Applications notes are presented for the new device with thyratron-like characteristics. ***F. W. Gutzwiller.*** *Electrical Manufacturing*, v. 62, Dec. 1958, p. 62 + 4 pages.

2822 Diffusion Concentration Profiles by Analog Computation. Simulation of diffusion processes on an analog computer permits solutions to the diffusion equations under boundary conditions which make analytical solutions impractical. Effects on transistor structure are shown for "slumping" and "outdiffusion" of the first diffusant in a double diffusion. Diffusion from a liquid alloy dot through a regrown region is well represented by an analytical solution except for very thin regrown regions or very long diffusion times. Diffusion through two layers of material with different diffusion coefficients gives profiles which may deviate widely from the error function complement. ***Worden Waring.*** *Electrochemical Society, Journal*, v. 105, Dec. 1958, p. 702-705.

2823 Semiconducting Compounds—A Challenge in Applied and Basic Research. The use of a number of semiconducting compounds in device applications is discussed for categories defined by the external field which produces a modulation of the carrier density or mobility. Included are applications based on response to electric fields, magnetic fields, thermal fields, photon energy, and thermal energy. The implications of recent investigations as regards band structure, states densities, charge carrier mobilities, crystal imperfections, and other basic characteristics are presented. ***A. C. Beer.*** *Electrochemical Society, Journal*, v. 105, Dec. 1958, p. 743-751.

2824* Properties of Germanium Diodes Determined for Parallel and Series Connection. Systematic measurements were made of the characteristics of germanium diodes subjected to various loads and overloads in the forward and reverse directions. The experimental methods and the equipment used are described briefly. (*In Czech.*) Vlastnosti germaniových diod určených k paralelnímu a sériovému řazení. ***Jaroslav Kramář and Vlastimil Horáček.*** *Elektrotechnický Obzor*, v. 47, no. 11, Nov. 1958, p. 558-564.

2825 Performance of Some Radio Systems in the Presence of Thermal and Atmospheric Noise. Methods are considered for calculating errors expected from a given system, based upon the amplitude distribution of the noise envelope. ***A. D. Watt, R. M. Coon, E. L. Maxwell, and R. W. Plush.*** *I.R.E. Proceedings*, v. 46, Dec. 1958, p. 1914-1923.

2826 Structure-Determined Gain-Band Product of Junction Triode Transistors. This paper discusses some fundamental limitations of the junction triode. It also describes briefly practical accomplishments with germanium diffused base transistors of the type reported by Lee. The frequency limitations of the junction triode are compared with those of the field effect transistor and the analog transistor. ***J. M. Early.*** *I.R.E. Proceedings*, v. 46, Dec. 1958, p. 1924-1927.

2827 Mode Conversion Filters. Resonance of higher order modes in waveguides can be advantageously used to make band rejection filters of unusual simplicity and low loss. The region where the resonance takes place can be obtained either by a change of cross section of the waveguide or by the inclusion of dielectrics. The relative advantages and experimental results obtained at 11 and 55 kmc are discussed. Finally it is shown how to use the resonance of converted modes to design channel dropping filters. ***E. A. Marcatili.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 3. (TK1 In6.61w Vis.)

2828 Properties of the H-Guide at Microwaves and Millimeter Waves. Wave propagation in the H-guide is investigated theoretically and experimentally. The over-all results suggest modifications of the original structure and permit the conclusion

that the guide is particularly suitable for the frequency range above 20 KMC. ***F. J. Tischer.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 4-12. (TK1 In6.61w Vis.)

2829 The Effects of Mode Conversion in Long Circular Waveguide. ***W. D. Warters and H. E. Rowe.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 13-20. (TK1 In6.61w Vis.)

2830 A New Class of Artificial Dielectrics. . . . applicable in the construction of large-size microwave lenses. ***Ming-Kuei Hu and David K. Cheng.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 21-25. (TK1 In6.61w Vis.)

2831 An Accurate Frequency Measuring Technique Using Paramagnetic Resonance Phenomena in the X-Band Region. A material containing spinning nuclei is inserted in an r.f. coil and the entire assembly is placed between the pole faces of an electromagnet which is capable of producing extremely homogeneous fields. The two resulting magnetic fields are then oriented at right angles to each other. By perturbing the magnetic field one can observe a resonance between the precessional frequencies of the nuclei and the applied r.f. field. By varying the magnetic field resonance will occur at a different frequency, and by varying it over a wide enough range a considerable spread of frequencies is obtained. These frequencies can be accurately measured by the use of an r.f. wavemeter or by an IF detection system. ***Paul Alexander Crandell.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 26-34. (TK1 In6.61w Vis.)

2832 The Power Handling Capacity of Slab Lines. A highly accurate determination of the power handling capacity of slab lines consisting of a circular cylindrical inner conductor centrally located between two parallel conducting plates. The power capacity of this line is compared to that of a coaxial transmission line. ***G. M. Badoyannis.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 35-38. (TK1 In6.61w Vis.)

2833 RF Circuits for a Voltage-Tunable Magnetron. A small external circuit is described which resulted in spurious-free operation with 25-dbm ± 1.8-db power output over the 2- to 4-kmc frequency range and a tuning curve which is linear to within ± 12 mc. ***Wilbur J. Gemulla.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 39-47. (TK1 In6.61w Vis.)

2834 An S-Band Two-Phase Demodulator. A circuit is described which is designed to provide image rejection by phase cancellation in a 2- to 4-kmc receiving system. Infinite image rejection is possible when the demodulator circuit delivers to the IF preamplifiers two equal amplitude IF output signals which differ in phase by 90 degrees. Dual rf demodulation, IF outphasing, and gating of the IF amplifier are combined to accomplish image rejection. ***R. B. Wilds.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 48-53. (TK1 In6.61w Vis.)

2835 Some Notes on Strip Transmission Line and Waveguide Multiplexers. This paper describes techniques which have been developed to facilitate the design of r-f multiplexers within the frequency range of 1.0 to 15.0 kmc. Strip transmission line filters are discussed which use tuning screws, physical variations of cavity lengths, and replaceable gaps. Waveguide multiplexing is accomplished by using hybrid junctions, resulting in essentially no passband deterioration. ***D. Alstadter and E. O. Houseman, Jr.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 54-69. (TK1 In6.61w Vis.)

2836 On the Solution of Some Microwave Problems by an Analog Computer. This paper describes an analog-computer method for solving algebraic equations arising in microwave theory. The problems of the bandwidth-response characteristics of a stagger-tuned six-cavity klystron amplifier, the bandwidth-response characteristics of a multiple-element impedance-matching system. The propagation characteristics for waveguides partially filled with two dielectric media are considered and their graphical solutions are given. ***Donald M. Byck and Allen Norris.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 70-85. (TK1 In6.61w Vis.)

2837 Forward Scatter of Electromagnetic Waves by Spheres. The paper deals with the far-zone wave field scattering forward from reflecting spheres. The paper describes the basic theoretical background of some characteristics of the forward-scatter field patterns and confirms their existence by actual bistatic cross-section measurements at X-band. ***W. E. Kock, J. L. Stone, J. E. Clark, and W. D. Friedle.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 86. (TK1 In6.61w Vis.)

2838 Propagation Through Random Distributions of Spheres. A general theory for propagation through random distributions of arbitrary objects is applied to treat "gases" of spheres large compared to wavelength. The design of "macroscopic gas" is described and statistical information required for interpreting microwave measurements is given. A 5-millimeter range for measuring scattering from extended random distributions of objects is described, and data on random volume distributions of several types of spherical scatterers are given. ***C. I. Beard and V. Twersky.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 87-100. (TK1 In6.61w Vis.)

2839 Surface Waves on a Right Angled Wedge. A theoretical investigation of the fields produced by a line source located at the vertex of a right angled wedge, both of whose faces can sustain surface waves. The results are compared with similar results valid for a line source on an infinite plane. The method employed can be applied to treat wedges of more general angles. ***Samuel N. Karp and Frank C. Karal, Jr.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 101-103. (TK1 In6.61w Vis.)

2840 New Concepts in the Statistical Study of Tropospheric Scatter Propagation Data. A summary of the analyses of sampling period of fast fading, effect of detector time constant on fast fading distribution, fading rate distribution, rate of change of signal level, long term minutely median distribution, long term instantaneous signal distribution, and duration and occasion of fast fades. Several of these analyses are believed to be new concepts that have never been tried before. ***Leang P. Yeh.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 104-122. (TK1 In6.61w Vis.)

2841 Circular Electric Waves Propagating Through the Circular Waveguide Containing a Circumferentially Magnetized Ferrite Cylinder. Describes a mathematical analysis of the problem. Numerical examples are illustrated especially with respect to the lowest circular electric, TE_{01}, mode. ***Nobuaki Kumagai and Kiyomi Takeuchi.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 123-130. (TK1 In6.61w Vis.)

2842 A Wide-Band Nonreciprocal Tem-Transmission-Line Network. Describes the results of preliminary measurements of the performance of the gyrator and isolator forms of the nonreciprocal TEM-transmission-line network. ***E. M. T. Jones, S. B. Cohn, and J. K. Shimizu.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 131-134. (TK1 In6.61w Vis.)

2843 Field Displacement Effects in Dielectric and Ferrite Loaded Waveguides. A transverse electric field detector is described and some of its limitations are discussed. The field pattern in rectangular waveguide has been measured for varying slab positions, thickness, and dielectric constant. The effect of varying the parameters, especially with regard to the nonreciprocal nature of the field patterns, is discussed. ***T. M. Straus.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 135-146. (TK1 In6.61w Vis.)

2844 Experimental Techniques in Measuring Ferrite Line Widths With a Cross-Guide Coupler. Experimental results are presented to show the effect on the line width of the sample size and the surface finish of a YIG sphere measured in a cross-guide coupler. This paper deals only with the effect on the line width of the sample size and the surface roughness of the sample. ***Donald C. Stinson.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 147-150. (TK1 In6.61w Vis.)

2845 Tee Circulator. A new three-port circulator has been made by putting a magnetized ferrite post in the junction of a standard H-plane waveguide tee. Its application, limitations, and the experimental data obtainable are discussed. ***William E. Swanson and Gershon J. Wheeler.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 151-156. (TK1 In6.61w Vis.)

2846 Arbitrarily Polarized Slot Array. Describes the theory of operation and experimental tests of a linear array which requires no mechanical motion to achieve polarization control

and whose polarization character is sensitive to variations in the operating frequency. ***H. H. Hougardy and H. E. Shanks.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 157-160. (TK1 In6.61w Vis.)

2847 Logarithmically Periodic Antenna Arrays. The theory and design procedure for an array of endfire log periodic elements is described. Design data for the element unit patterns and phase centers is presented. Experimental as well as theoretical array patterns are given. ***R. H. DuHamel and D. G. Berry.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 161-174. (TK1 In6.61w Vis.)

2848 Impedance Properties of Antenna Arrays. An analysis is presented of the impedance properties of typical radiating elements in large arrays. ***S. Edelberg and A. A. Oliner.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 175-177. (TK1 In6.61w Vis.)

2849 Antenna Pattern Synthesis of the Most Truthful Approximation. This paper shows that the sampling theorem of the information theory must be applied to the problem of antenna pattern synthesis in order to preserve a maximum of information contained in the pattern under the restrictions imposed by the physically limited antenna. ***Herbert P. Raabe.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 178-183. (TK1 In6.61w Vis.)

2850 A Rapid-Scanning Phased Array for Propagation Measurements. This report describes the pertinent design considerations, construction and measurements on an S-band broadside antenna array in which each radiating element consists of a parabolic reflector which is fed by a helix radiator and local ground plane. ***R. E. Miller, A. T. Waterman, Jr., G. K. Durfey, and W. H. Huntley, Jr.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 184-196. (TK1 In6.61w Vis.)

2851 The Influence of Radar Reflection Characteristics of the Moon on Specifications for Earth-Moon-Earth Communication Systems. This paper discusses the moon reflection theory, echo pulse shapes, and the possibility of communication via the moon. ***T. B. A. Senior, K. M. Siegel, and H. Weil.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 197-201. (TK1 In6.61w Vis.)

2852 A Microwave Technique to Reduce Platform Motion and Scanning Noise in Airborne Moving Target Radar. The results of an investigation of an airborne moving target radar, which substantially eliminates platform motion noise and scanning noise, are summarized. ***Dean B. Anderson.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 202-211. (TK1 In6.61w Vis.)

2853 A Concentric Loop Array. Discusses the properties of thin wire loops of several wavelength circumferences in an attempt to point out some of the desirable features of their radiation fields. Analyzes an array of these loops, in order to demonstrate a particular use of dissimilar driven elemeats in an array, and a method of synthesis of radiation patterns. ***Allan C. Schell and Edmund L. Bouché.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 212-218. (TK1 In6.61w Vis.)

2854 Theory and Design of a Class of Luneberg Lenses. This paper summarizes and classifies a large number of Luneberg lenses. Several applications of the higher-order lenses are discussed. ***J. Richard Huynen.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 219-230. (TK1 In6.61w Vis.)

2855 Obstacle Gain at Microwave Frequencies. This paper discusses experimental methods and results, describes siting and prediction techniques, and outlines the instrumentation employed in a study and experimental investigation of the obstacle gain effect in the microwave region. ***Samuel R. Bradshaw.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 231-242. (TK1 In6.61w Vis.)

2856 A Broadband, Low Sidelobe, Radar Antenna. This paper describes the "corporate structure" feed network of a search radar antenna capable of generating a fan beam 1-¼° in azimuth by 30° in elevation. The antenna properties and the experimental results obtained are discussed. ***A. M. McCoy, J. E. Walsh, and C. F. Winter.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 243-250. (TK1 In6.61w Vis.)

2857 A Class of Low Gain Broadband Antennas. The experimental characteristics of a class of small, low and medium gain, broadband antennas are discussed. Theoretical analysis and comparison with more common antenna structures are also presented. Included were structures having such characteristics as medium gain, uniform patterns, and balanced feeding over a wide frequency range. ***B. J. Lamberty.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 251-259. (TK1 In6.61w Vis.)

2858 Illuminating Curved Passive Reflector With Defocused Parabolic Antenna. A simple expression of the gain of a curved passive reflector antenna is given. It is found that the antenna system gain is maximum if the operating wavelength times the tower height is made equal to twice the product of the radii of the curved passive reflector and its illuminating parabolic antenna. It is shown that the effective radius of the illuminating antenna may be varied by moving its feed away from the focus toward the reflector, and that the gain of the curved passive reflector antenna may be maximized by this feed defocusing technique. ***Richard F. H. Yang.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 260-265. (TK1 In6.61w Vis.)

2859 Reflector-Type Periodic Broadband Antennas. Operation of a logarithmically periodic radiating element over a reflecting cavity is described, and the limitations on frequency bandwidth are discussed. Methods of overcoming these limitations are presented. Data are presented on two operating models: one, covering a 3-to-1 frequency band with a maximum VSWR of 3 to 1, and the other covering a 4.5-to-1 band with a peak VSWR of 5 to 1. ***R. E. Franks and C. T. Elfving.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 266-271. (TK1 In6.61w Vis.)

2860 The Parabolic Dome Antenna: A Large Aperture, 360 Degree, Rapid Scan Antenna. The authors present the results of an extensive investigation into the design and scale model testing of a dome-like, parabolic torus antenna, capable of providing one or more complete 360 degree rotating pencil beams in azimuth. This antenna can be used to provide multiple fixed pencil beams in both azimuth and elevation for instantaneous direction finding system requirements. ***J. D. Barab, J. G. Marangoni, and W. G. Scott.*** *IRE Wescon Convention Record*, v. 2, pt. 1, 1958, p. 272-293. (TK1 In6.61w Vis.)

2861* A Flat Television Tube. ***D. Gabor.*** *Institution of Electrical Engineers, Journal*, v. 4, no. 47, Nov. 1958, p. 609-612.

2862* The Response of Non-Linear Devices to Band Limited High Frequency Signals and Noise. Results obtained for discrete sinusoidal signals are shown to be applicable to the continuous spectra of high frequency noise without recourse to probability theory. ***N. W. W. Smith.*** *Journal of Electronics and Control*, v. 5, no. 5, Nov. 1958, p. 385-401.

2863* Concerning Magnetic Field Exploration Using Electron Paramagnetic Resonance at Centimetre and Millimetre Wavelengths. Applies to exploring the fields of microwave-valve magnets, having field strengths between several hundred and several tens of thousands of gauss. ***Arthur Karp.*** *Journal of Electronics and Control*, v. 5, no. 5, Nov. 1958, p. 402-404.

2864* Designing for Reliability in Electronic Instrumentation. An attempt is made to highlight the major factors, practical and philosophical, which contribute to reliability design. ***R. E. Fischbacher.*** *Journal of Electronics and Control*, v. 5, no. 5, Nov. 1958, p. 471-482.

2865 Growth of Electric Space-Charge and Radio Waves in Moving Ion Streams. In a medium comprising two identical interpenetrating ion streams, four electric space-charge phenomena may occur. The 'fast' and 'slow' traveling waves do not concern us; the two effects of interest are non-traveling in a system in which the medium as a whole is at rest. ***J. H. Piddington.*** *Philosophical Magazine*, v. 3, ser. 8, Nov. 1958, p. 1240-1255.

2866* The Problem of Development of Super-High Frequency Ferrite Amplifiers. Design principles of new type low-noise amplifiers which utilize ferrites. Theory of phenomena on which the operation of ferrite generators and amplifiers is based, and a short review of published articles. Discussion of the

first experimental results in realization of ferrite amplifiers. (*In Russian.*) Problema sozdaniia ferritovykh usilitelei na sverkhvysokikh chastotakh. ***A. L. Mikaelian.*** *Radiotekhnika i Electronika,* v. 3, no. 11, Nov. 1958, p. 1323-1347.

2867* Propagation of Radio Waves Along the Near-Ground Tropospheric Waveguide. Mathematical methods are developed for calculating the attenuation factor in the presence of supperrefraction. More exact criteria are given for determining the presence or absence of extra-long distance propagation, depending upon the properties of the inversion layer and wavelength. (*In Russian.*) Rasprostranenie radiovoln po prizemnomu troposfernomu volnovodu. ***V. A. Fok, L. A. Vaĭnshteĭn, and M. G. Belkina.*** *Radiotekhnika i Elektronika,* v. 3, no. 12, Dec. 1958, p. 1412-1429.

2868* Study of the Radio Wave Dispersion on Tropospheric Inhomogeneities of the Refraction Index by the Method of Radioastronomic Measurements. The intensity of the dispersed radio emission of the sun was measured using 3.2 cm. radio waves. The experimental data obtained are compared with the theoretical evaluation. (*In Russian.*) Izuchenie rasseianiia radiovoln na troposfernykh neodnorodnostiakh pokazatelia prelomleniia metodom radioastronomicheskikh izmereniĭ. ***M. A. Evdokimov.*** *Radiotekhnika i Elektronika,* v. 3, no. 12, Dec. 1958, p. 1430-1440.

2869* Influence of the Recombination of the Non-Rectifying Electrode on the Properties of Alloyed Germanium Diodes. The relationships between the thickness of the base of alloyed Ge-In diodes and their saturation current, diffusion capacitance, resistance, critical frequency, and frequency capacitance were determined experimentally. The recombination rate of the second (nonrectifying) tin and copper electrodes was evaluated. (*In Russian.*) Vliianie rekombinatsii u nevypriamliaiushchego elektroda na svoĭstva splavnykh germanievykh diodov. ***N. A. Penin and K. V. Cherkas.*** *Radiotekhnika i Elektronika,* v. 3, no. 12, Dec. 1958, p. 1495-1500.

2870 Semiconductors and Phosphors. This collective volume presents the proceedings of the International Colloquium 1956 "Semiconductors and Phosphors" at Garmisch-Partenkirchen. It includes approximately 100 lectures. (*In English and German.*) Halbleiter und Phosphore. ***M. Schön and H. Welker, editors.*** 684 pp. 1958. Interscience Publishers, New York. (QC611 In8s)

2871* Signal Translation Through the Ampex Videotape Recorder. Describes the various operations performed on the video signal as it travels through the Ampex Videotape Recorder. Outlines the history of each problem and some of the reasons for the solution applied. ***Charles E. Anderson.*** *Society of Motion Picture and Television Engineers, Journal,* v. 67, Nov. 1958, p. 721-729.

2872* Electronic Marking and Control for Rapid Location of Vertical Blanking Area for Editing Video-Tape Recordings. A relatively simple and inexpensive method for splicing video tape has been developed. Three problems were investigated: (1) visual "development" of the video track; (2) accurate positioning of the splice; (3) joining tapes to achieve maximum mechanical strength. Electronics have been included in production machines to provide accurately spaced "edit" pulses to position the splice. Simplified tray spray "development" methods have been attained. ***Joseph Roizen.*** *Society of Motion Picture and Television Engineers, Journal,* v. 67, Nov. 1958, p. 732-733.

2873* State of the Art: Radar. High power microwave amps and components, statistical design concepts, and low noise UHF and microwave components are reviewed briefly. ***James Holahan.*** *Space/Aeronautics,* v. 31, no. 1, Jan. 1959, p. 25 + 9 pages.

2874* Reliability and Stability Most Critical in Satellite Communications. Presents a condensed version of a detailed study of satellite reconnaissance. *Space/Aeronautics,* v. 31, no. 1, Jan. 1959, p. 38 + 7 pages.

2875* Spiral Antennas Meet Needs of New Vehicles. Reviews some advanced antenna designs for high performance aircraft and missiles. ***Edwin M. Turner.*** *Space/Aeronautics,* v. 31, no. 1, Jan. 1959, p. 56 + 6 pages.

2876* Information Theory Plays Major Role in New Radar Designs. ***James P. Holahan.*** *Space/Aeronautics,* v. 30, no. 6, Dec. 1958, p. 138 + 9 pages.

2877 Space-Charge Waves and Slow Electromagnetic Waves. The theory and operation of most known microwave tubes are investigated on the basis of the interaction of two wave systems: the first, that observed on the circuit in the absence of an electron beam; the second, that on the beam in the absence of circuit waves. ***A. H. W. Beck.*** 396 pp. 1958. Pergamon Press, New York. (TK7872.V3 B38s)

2878* Preventive Design Aspects of Radio-Frequency Interference Control. This paper presents some of the concepts of preventive r-f interference control that have been found practical in the design of components and systems. ***Harold R. Schwenk.*** *Sperry Engineering Review,* v. 11, no. 4, Dec. 1958, p. 15-22.

2879* Semiconducting Compounds With a General Formula ABX_2. Results of investigation of a series of ternary compounds with a general formula ABX_2 which crystallize in chalcopyrite structure; and information on new ternary compounds with the same general chemical formula, some of which crystallize in tetragonal system. All these compounds appear to be semiconductors. Consideration of the problem on the chemical bond in ABX_2 type compounds. (*In Russian.*) Poluprovodnikovye soedineniia s obshchei formuloi ABX_2. ***V. P. Zhuze, V. M. Sergeeva, and E. L. Shturm.*** *Zhurnal Tekhnicheskoi Fiziki,* v. 28, no. 10, Oct. 1958, p. 2093-2108.

See also: **2950** (auroral effects on Northern communications); **3560** (dielectric properties of reinforced plastics).

ENGINEERING ECONOMICS

2880 R&D Feels Government's Impact. Evaluates good and bad effects of heavy government R&D spending on industry and universities. *Chemical and Engineering News,* v. 36, no. 52, Dec. 29, 1958, p. 63 + 4 pages.

2881 Electric-Furnace Ferro-Alloy Industry in America. Surveys of trends in capacity, production, and processes for nine American companies. ***J. H. Brennan, H. E. Dunn, and C. M. Cosman.*** *Journal of Metals,* v. 10, Dec. 1958, p. 785-789.

2882 Manganese and Chrome Ore Outlook. Attempts to answer the following questions regarding the long-term outlook for these key commodities. By 1970, what will be the probable demand here and abroad, what are future supply prospects, and what effect is the USSR likely to have on the world market? ***John M. Warde and Eileen P. Burke.*** *Journal of Metals,* v. 10, Dec. 1958, p. 790-795.

2883* Comparative Data on the Total Cost of Generation of Conventional and Nuclear Power Stations. ***J. R. Finniecome.*** *Mechanical World and Engineering Record,* v. 138, Dec. 1958, p. 534-536.

2884* Tin—First Target of Soviet Trade War. The international tin situation with particular reference to its bearing on canning activities. ***R. D. Coursen.*** *Metals,* v. 29, no. 6, Dec. 1958, p. 11 + 1 page.

2885* Evaluation of United States Oil Resources as of January 1, 1958. ***Paul D. Torrey.*** *Mines Magazine,* v. 48, Dec. 1958, p. 25-28.

FLUID MECHANICS

2886* The Variation of Flow Resistance in Rapidly Rotating Tubes. For a given configuration, the flow resistance of rapidly rotating tubes does not depend on Reynold's number, but only on the ratio u/w. (*In German.*) Über die Änderung des Strömungswiderstandes in schnell rotierenden Rohrleitungen. ***L. Kisbocskói.*** *Acta Technica Academiae Scientiarum Hungaricae,* v. 22, nos. 1-2, 1958, p. 121-128.

2887* On the Heavy Suspension Developing in the Hydrocyclone. ***G. Tarján.*** *Acta Technica Academiae Scientiarum Hungaricae*, v. 21, nos. 3-4, 1958, p. 387-402.

2888* Heat Transfer by Laminar Free Convection About a Vertical Flat Plate With Large Temperature Difference. The problem is solved, taking into account the variation of properties of air which depends on temperature. The heat-transfer coefficient is given for air. ***Tomoshige Hara.*** *Bulletin of JSME*, v. 1, no. 3, Aug. 1958, p. 251-254.

2889* On Vibration of an Ideal Fluid Contained in an Annular Region Bounded by Two Eccentric Circular Cylinders. (Case of Finite Amplitude). Presents fundamental relations for vibration of fluid. ***Fumiki Kito.*** *Bulletin of JSME*, v. 1, no. 3, Aug. 1958, p. 293-297.

2890 By Proper System Design—Assure Full Range Flow Control. In design calculations, include joint effect of control valve pressure drop, system friction loss and pump discharge pressure. ***Joseph Conison.*** *Chemical Engineering*, v. 65, Dec. 1, 1958, p. 107-110.

2891 The Flow of Lubricating Greases. Over a wide range of shear rates the data lie on a single smooth curve and are fitted by a new equation which can be used to calculate pressure drops in pipe flow and to explain the appearance of plug flow in greases. ***A. W. Sisko.*** *Industrial and Engineering Chemistry*, v. 50, Dec. 1958, p. 1789-1792.

2892 Flow of Dense Pastes in Vertical Tubes. Flow characteristics of pastes were studied for systems in which solid particles are conveyed at the highest possible packing density. ***Seymour Calvert and Robert H. Miller.*** *Industrial and Engineering Chemistry*, v. 50, Dec. 1958, p. 1793-1798.

2893 Unsteady Laminar Boundary Layers in an Incompressible Stagnation Flow. Deals with unsteady laminar boundary layers in the immediate vicinity of the stagnation point of a heated blunt-nosed cylinder in an incompressible flow with unsteady velocity. An exact solution is presented for the special case of a flow velocity varying inversely with a linear function of time, together with calculated boundary-layer characteristics for different values of a flow parameter. An approximate method of solutions is proposed for a more general problem where the flow velocity changes arbitrarily with time. ***Kwang-Tzu Yang.*** *Journal of Applied Mechanics*, v. 25, no. 4, Dec. 1958, p. 421-427.

2894 Laminar Flow in a Uniformly Porous Channel. The problem of laminar channel flow is investigated for the case of uniform fluid suction or injection through the channel walls. ***F. M. White, Jr., B. F. Barfield, and M. J. Goglia.*** *Journal of Applied Mechanics*, v. 25, no. 4, Dec. 1958, p. 613-617.

2895* The Effect of Temperature on the Flow Properties of Clay-Water Drilling Muds. Flow property variation with temperatures to 200 F of clay-water muds may be predicted by this method. ***S. Srini-Vasan and Carl Gatlin.*** *Journal of Petroleum Technology*, v. 10, Dec. 1958, p. 59-60.

2896 Turbulent Heat Transfer Through a Highly Cooled, Partially Dissociated Boundary Layer. The problem of heat transfer from high-temperature air through a turbulent boundary layer to a cold surface is considered both analytically and experimentally. Heat-transfer data obtained in shock tubes are presented and correlated by a semiempirical theory which includes the effect of atomic diffusion. The distinguishing characteristics of turbulent boundary layers with dissociation and large cooling are considered. ***Peter H. Rose, Ronald F. Probstein, and Mac C. Adams.*** *Journal of the Aero/Space Sciences*, v. 25, Dec. 1958, p. 751-760.

2897 On Pitot Pressure in an Almost-Free-Molecule Flow—A Physical Theory for Rarefied-Gas Flows. A physical theory of Pitot pressure in the transition-flow regime—i.e., the moderately-rarefied-gas-flow region—is proposed. The ratio λ/b (the mean free path to the radius of the cavity opening) is assumed to be of the order unity or larger. A general formula for the perturbation to the Pitot pressure in the free-molecule flow is given. ***V. C. Liu.*** *Journal of the Aero/Space Sciences*, v. 25, Dec. 1958, p. 779-785.

2898* Unresolved Problems of Fluid Mechanics. Conclusions drawn from a survey of industry, government and university personnel in both research and design. ***S. J. Kline and R. C. Dean, Jr.*** *Mechanical Engineering*, v. 80, Dec. 1958, p. 54-55.

2899* Phenomenological Free Streamline Theory. I. Flow Past a Normal Plate. The above is discussed phenomenologically by the free streamline theory. The pressure distribution on the plate is determined by the pressure distribution on a free streamline which is obtained as a function of the distance from the separation point. In case when the latter is obtained only in the "free streamline range" (e.g., the range from the separation point to a distance equal to about one and a half of the breadth of the plate), the pressure distribution and other quantities on the normal plate are estimated with their probable deviations. ***Yoichi Mimura.*** *Physical Society of Japan, Journal*, v. 13, Nov. 1958, p. 1361-1374.

2900* Flow Measuring of Gases of Varying Working Densities. A continuous flow computing system which works with a force-balance measuring transmitter and a simple analogue computer without moving parts, is described. (*In German.*) Zur Durchflussmessung von Gasen veränderlicher Betriebswichte. ***H. Kronmüller.*** *Regelungstechnik*, v. 6, no. 11, 1958, p. 391-395.

2901 Radiation Attenuation Method of Measuring Density of a Two-Phase Fluid. A gamma-ray attenuation technique is presented for measuring density and phase distribution in a two-phase fluid. A comparison is made between a "one-shot" and traverse method. The technique was evaluated on Lucite mock-ups of simulated flow patterns encountered in two-phase flow and by a series of tests on an air-water system at atmospheric pressure. ***Michael Petrick and Bernet S. Swanson.*** *Review of Scientific Instruments*, v. 29, Dec. 1958, p. 1079-1085.

2902* Measurements of Skin Friction in a Plane Turbulent Wall Jet. Considers the inner layer of fluid between the wall and the position where the velocity is a maximum as a boundary layer with an outer uniform free stream of velocity equal to the local maximum velocity. ***A. Sigalla.*** *Royal Aeronautical Society, Journal*, v. 62, Dec. 1958, p. 873-877.

2903* Thermodynamics of Inner Friction Process in Material Systems. Thermodynamic importance of relaxation spectra in discussing processes of rheology and to certain thermic effects occurring in elastic strain of the systems. (*In Polish.*) Termodynamika procesu tarcia wewnętraznego w układach materialnych. ***Jan Wojtczak.*** *Wiadomości Chemiczne*, v. 12, Sept. 1958, p. 497-510.

2904* The Boundary Layer Equations of Compressible Flow. Separation. The equations of motion, continuity and energy of compressible boundary layer are reduced to one equation identical with the equation for incompressible flow. It is applied to the case of flow past a plane with separation induced by a shock wave. An improved method of integration is indicated. ***D. Meksyn.*** *Zeitschrift für Angewandte Mathematik und Mechanik*, v. 38, nos. 9-10, Sept.-Oct. 1958, p. 372-379.

See also: **2574** (fluidized Fullers earth); **2913** (heat-driven oscillations of gas flows); **3017** (flow in centrifugal blowers).

FOOD TECHNOLOGY

2905* Space Nutrition. ***Jane C. Ebbs.*** *American Dietetic Association, Journal*, v. 35, Jan. 1959, p. 13-16.

2906* Chemicals in Foods. Surveys the occurrence of physiologically active minor chemical constituents which may be fully as important to the health of the consumer as are chemical additives. ***Floyd DeEds.*** *American Dietetic Association, Journal*, v. 35, Jan. 1959, p. 19-22.

2907* Supplementary Relationships of Proteins. At a 10% dietary protein level, beef and casein were superior to a cereal blend as supplements to bread protein. ***R. H. Hartman and***

E. E. Rice. *American Dietetic Association, Journal*, v. 35, Jan. 1959, p. 34-37.

2908* Polycyclic Hydrocarbons in Icelandic Smoked Food. The only strong carcinogen found in the smoked food is 3:4 benzpyrene, of which 2.1 μg./kg. was found in smoked trout. ***Esmé J. Bailey and Niels Dungal.*** *British Journal of Cancer*, v. 12, no. 3, Sept. 1958, p. 348-350.

2909 Some Preliminary Studies on Meat Flavor. Flavor constituents were largely water soluble in both the cooked and raw meat. However, cooking prior to extraction increases the flavor threshold, indicating that full flavor development may be due to heating of juices and fibers together. ***W. E. Kramlich and A. M. Pearson.*** *Food Research*, v. 23, no. 6, Nov.-Dec. 1958, p. 567-574.

2910 Effect of Certain Chemicals in Water on the Flavor of Brewed Coffee. Taste thresholds have been estimated in redistilled water and coffee brew for six odor-producing chemicals and for four non-volatile compounds used in water treatment. Threshold concentrations were generally found to be well above amounts of the chemicals found in public water supplies. ***C. L. Campbell, R. K. Dawes, S. Deolalkar, and M. C. Merritt.*** *Food Research*, v. 23, no. 6, Nov.-Dec. 1958, p. 575-579.

2911 Acceptability of Fresh and Precooked Radiated Meats. Fresh and precooked beef and pork roasts, steaks, chops, and fresh bacon were radiated at levels of 1.9 and 2.8 megarad and stored at 72 F for periods up to 250 days. In radiated fresh meats, extensive degradative changes resulted in meat unfit for consumption. There was no significant change in the flavor of precooked and radiated beef and pork roasts, steaks and chops during storage at 72 F for 250 days and the products were considered acceptable at the end of the storage period. ***R. F. Cain, et al.*** *Food Research*, v. 23, no. 6, Nov.-Dec. 1958, p. 603-610.

FUELS AND COMBUSTION

2912* Total Gasification of Brown Coal Under Pressure With Oxygen and Steam in a Pilot Plant. Effect of pressure and steam-oxygen ratio on characteristics of the process and composition of the gas. (*In Ukrainian.*) Gazifikatsiia burogo vugillia pid tiskom z paro-kisnevim duttiam u napivpromislovikh umovakh. ***V. I. Tolubins'kii and M. I. Rabinovich.*** *Akademiia Nauk Ukrains'koi RSR, Dopovidi*, 1958, no. 10, p. 1067-1069.

2913* Analysis of Heat-Driven Oscillations of Gas Flows. V. Influence of Heat Transfer in the Burner Ports on the Stability of Combustion of Premixed Gases. The fluctuating heat transfer in the burner ports and especially the fluctuations in the temperature of the gas at the exit of the burner ports are related to the fluctuations in velocity by means of transfer functions. ***H. J. Merk.*** *Applied Scientific Research, Sec. A, Mechanics, Heat, Chemical Engineering, Mathematical Methods*, v. 8, no. 1, 1958, p. 1-27.

2914* Calculation of Gas Radiation From a Rectangular Parallelepiped Gas Mass Surrounded by Transparent Gas. I. The Emissivity of a Gas Mass Radiating to Furnace Walls. On the assumptions that a radiating gas mass having a uniform coefficient of absorption exists in the center of the furnace and that between radiating gas mass and walls exists transparent gas, the emissivity of a gas mass radiating to furnace walls and the frequency distribution of the heat-flow intensity on furnace walls are calculated. ***Seikan Ishigai, Yasuo Yamasaki, and Atsushi Hashimoto.*** *Bulletin of JSME*, v. 1, no. 3, Aug. 1958, p. 255-261.

2915* Boron Hydrides. Gives the history of the discovery of B and its hydrides followed by their preparation, structure, and their chemical and physical properties. (*In French.*) Les dérivés hydrogénés du bore. ***J. Cueilleron.*** *Chimie & Industrie*, v. 80, no. 5, Nov. 1958, p. 553-560.

2916* International Methods of Sampling and Analysis of Solid Fuels. II. Methods of sampling and sample preparation and the technique of coal preparation for the market. ***J. G. King.*** *Coke and Gas*, v. 20, Dec. 1958, p. 509-513.

2917* The Carbonisation of Coal in Coke Ovens. IV. *G. W. Lee.* *Coke and Gas*, v. 20, Dec. 1958, p. 524-529.

2918 Fuel Oil: What Every Heating Engineer Should Know. Questions and answers on the fundamentals of this vital fuel are listed. ***Willie Hammer.*** *Heating, Piping & Air Conditioning*, v. 30, Dec. 1958, p. 112-118.

2919* Mechanization, Automatic Control and Regulation in Coke-Works. Stresses the transport of coal, its storage in bins, the preparation of the charge, the grinding process, further to the work on the coke battery and finally to the automation of the coke platform, of transport and coke sorting. (*In Czech.*) Mechanisace, automatická kontrola a regulace v koksovnách. ***Miloslav Gottwald.*** *Hutnické Listy*, v. 13, no. 6, 1958, p. 481-490.

2920* A Flame Photometer for Measuring Sodium Aerosol Concentrations in Furnace Gases. The calibration of the instrument is described and factors affecting the accuracy of the method are discussed. The results of proving experiments and some field trials with the instrument are also given. ***D. Ounsted.*** *Institute of Fuel, Journal*, v. 31, no. 214, Nov. 1958, p. 474-479.

2921* The Selection and Use of Additives in Oil-Fired Boilers. Discusses troubles in modern power station boilers associated with oil firing, including the corrosion and blockage of high-and-low temperature surfaces swept by the flue gases. An account is given of experiences with several additives to relieve troubles of this kind. ***W. D. Jarvis.*** *Institute of Fuel, Journal*, v. 31, Nov. 1958, p. 480-491 + 1 plate.

2922* A Method of Studying the Influence of Flame Characteristics on Heat Transfer in Furnaces. An apparatus is described in which a small flame is burnt inside a vertical, cylindrical, insulated combustion chamber and results are given of measurements of the heat flow through the furnace walls, temperature, gas analysis and radiation characteristics of the flame. Experiments are described. ***A. M. Godridge, G. G. Thurlow, and J. Wallis.*** *Institute of Fuel, Journal*, v. 31, Nov. 1958, p. 491-505.

2923 Kinetic Studies of Hydroxyl Radicals in Shock Waves. II. Induction Times in the Hydrogen-Oxygen Reaction. The formation of OH in the shock wave induced combustion of H_2 and O_2 has been measured by oscillographically recording the absorption of ultraviolet OH line radiation. ***G. L. Schott and J. L. Kinsey.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 1177-1182.

2924* New Inhibitors of Fuel Oxidation and Additives for Increasing the Thermal Stability of Reactive Fuels. Synthesis and evaluation of alkylaminophenol, alkyl phenol and their esters as antioxidant additives for various type fuels. Introduction of alkyl group into aminophenol increases solubility of an additive in fuels and increases its effectiveness. Investigation of the effect of these additives on removal of insoluble deposits in standard reactive fuel T-1. (*In Russian.*) Novye ingibitory okisleniia topliv i prisadki dlia povysheniia termicheskoĭ stabil'nosti reaktivnykh topliv. ***F. N. Mazitova and Ia. M. Paushkin.*** *Khimiia i Tekhnologiia, Toplic i Masel*, v. 3, no. 11, Nov. 1958, p. 10-12.

2925 Octane Flexibility for D-X Sunray. Installation of new units at the Tulsa refinery to produce premium gasoline of 100 octane or better. ***Joe H. Miller.*** *Oil and Gas Journal*, v. 57, no. 1, Jan. 5, 1959, p. 92-96.

2926* Multifuel: New Problem for Refiners. Development of multifuel engines. *Petroleum Week*, v. 8, no. 1, Jan. 2, 1959, p. 20-21.

2927 Design Considerations of a Condensing System for Vaporized Magnesium. Various condensing chambers for vaporized Mg and the effect of design characteristics on Mg build-up at the chamber inlet. ***Walter R. Witzke, George M. Prok, and Thomas A. Keller.*** *U. S. National Advisory Committee for Aeronautics, Research Memorandum, RM* E55I20, Nov. 30, 1955, 19 pp. (TL782 Un3rm Vis.)

See also: **3134** (oil-fired furnaces).

GEOLOGY, GEOPHYSICS, MINERALOGY, AND MINING ENGINEERING

2928* Coefficient of Thermal Conductivity of the Earth Envelope. Coefficient consisting of the lattice part dependent on the usual mechanism of thermal conductivity in crystals—the diffusion of thermic stimulation of phonons and of the radiant part conditioned by the heat transfer caused by infra-red electromagnetic vibrations. Formula expressing the dependence on temperature and pressure. (*In Russian.*) O koeffitsiente teploprovodnosti obolochki zemli. ***V. N. Zharkov.*** *Akademiia Nauk SSSR, Izvestiia, Seriia Geofizicheskaia,* 1958, no. 11, p. 1342-1350.

2929* Significance of a Quantitative Determination of Rock Color in Studying Sedimentary Deposits of Uranium Ores. A precise photometric determination of the coloration of U-bearing carbonate rocks. Relationships between color and content of organic matter and various forms of Fe. (*In Russian.*) Znachenie kolichestvennogo opredeleniia tsveta porod pri izuchenii osadochnykh mestorozhdenii uranovykh rud. ***V. I. Danchev.*** *Akademiia Nauk SSSR, Izvestiia, Seriia Geologicheskaia,* 1958, no. 11, Nov., p. 71-83.

2930 Is Newton's Law of Gravitation Really Universal? An examination of the interactions between clusters of galaxies suggests Newton's law breaks down at distances considerably smaller than expected in any of the current cosmological theories. ***Fritz Zwicky.*** *Astronautics,* v. 4, Jan. 1959, p. 18 + 3 pages.

2931 Rocket Astronomy—Window Into Space. Rockets with "photocounter telescopes" show a new panorama of the heavens. ***Herbert Friedman.*** *Astronautics,* v. 4, Jan. 1959, p. 26 +3 pages.

2932 Mars—A World for Exploration. Presents mysteries of physical form and life. ***Clyde W. Tombaugh.*** *Astronautics,* v. 4, Jan. 1959, p. 30 + 9 pages.

2933 Weather Reconnaissance by Satellites. Promises to provide continuity in time and space to synoptic meteorology for the first time. ***S. M. Greenfield and W. W. Kellogg.*** *Astronautics,* v. 4, Jan. 1959, p. 32 + 3 pages.

2934 The Earth Satellite Orbit. Presents a complex geometry and perturbing forces not yet entirely identified. ***Ballard B. Small.*** *Astronautics,* v. 4, Jan. 1959, p. 40 + 3 pages.

2935* The Absolute Photometry of Venus in Ultraviolet and Infrared Rays. Procedure and results of photographic observations of Venus made with a 270 mm. reflector using ultraviolet and infrared color filters. (*In Russian.*) Absoliutnaia fotometriia venery v ul'trafioletovykh i infrakrasnykh luchakh. ***I. K. Koval'.*** *Astronomicheskii Zhurnal,* v. 35, no. 5, Sept.-Oct. 1958, p. 792-796.

2936* Determination of the Photographic Position of an Artificial Earth Satellite, Using Two Reference Stars. A method of determination by direct reference to two stars with known equatorial coordinates. Limiting the calculations to second order terms, the results can be found with a precision of 1′ in α and 0.2′ in δ for declinations $< 60°$, distances between the reference stars $< 3°$ and the distance from the optical center $< 15°$. In some cases for larger declinations it is necessary to take third order terms into account. (*In Russian.*) Opredelenie fotograficheskogo polozheniia iskusstvennogo sputnika zemli po dvum opornym zvezdam. ***A. N. Deich.*** *Astronomicheskii Zhurnal,* v. 35, no. 5, Sept.-Oct. 1958, p. 810-818.

2937 Parallactic Measurements on Aurorae Over Churchill, Canada. Height measurements on the lower edges of homogeneous and rayed arcs and bands are reported from 404 photographs taken of aurorae over Churchill (58.8°N., 94.2°W.) during the winter of 1957-58. The frequency distribution in height of 1975 points measured shows a double peak at 101 and 107 km, and a mean height of 104.8 km. ***D. J. McEwen and R. Montalbetti.*** *Canadian Journal of Physics,* v. 36, Dec. 1958, p. 1593-1600.

2938 Investigation of the Drifts of the Effective Point of Radio Reflection Along a Meteor Train. The concept of the effective point of radio reflection from a meteor train has been given on the basis of atmospheric turbulence, on a vertical scale of the order of 100 m to 6 km, in the *M* region. Some evidence supports the postulate of its drifting along the train, using meteoric body doppler radar records, taken on 30.02 Mc/s at South Gloucester, during the Geminid shower periods of 1948-50. ***M. Srirama Rao and R. L. Armstrong.*** *Canadian Journal of Physics,* v. 36, Dec. 1958, p. 1601-1623 + 1 plate.

2939* A Study of Structures of Molecular Complexes Found in Heavy Petroleum Fractions. Reviews in part the results of previous investigations and presents the results of some research work, pertinent to this subject. ***George W. LeMaire.*** *Colorado School of Mines, Quarterly,* v. 53, no. 4, Oct. 1958, 79 pp.

2940* Proposal of a Rule of Zonal Distribution of Uranium Concentrations Compared With Those of Plutonium. Uranium deposits or tracers are oftentimes associated with the existence of granulite. Mining prospecting can be advantageously oriented if based on the structural analysis of the crystalline and crystallophyllian complexes, without neglecting other "leads" such as minette fields and other iron-rich rocks. (*In French.*) Proposition d'une règle de répartition zonale des concentrations d'uranium par rapport aux plutons. ***Pierre Routhier and Jean-Pierre Gautsch.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences,* v. 247, no. 20, Nov. 17, 1958, p. 1750-1753.

2941* Water Characteristics of Atlantic Ocean and of World Ocean. Statistics from 105 uniformly distributed hydrographic stations are presented on a pair of characteristic diagrams, each having potential temperature and salinity as coordinates, potential specific-volume anomaly being represented by isopleths. ***R. B. Montgomery.*** *Deep-Sea Research,* v. 5, no. 2, Nov. 1958, p. 134-148.

2942* Drilling—1975. A look ahead—the problems faced with holes 50,000 ft. deep. ***R. O. Childers.*** *Drilling,* v. 20, Dec. 1958, p. 47-50.

2943* Neutron Log Tools Require Calibration and Standardization. Standardization procedure assures that all PGAC neutron logs are obtained with instruments possessing response characteristics identical to the standard instrument utilized for deriving the published porosity evaluation charts. ***W. R. Rabson.*** *Drilling,* v. 20, Dec. 1958, p. 71.

2944* Potassium-Argon Age of Iron Meteorites. Under the usual assumptions accepted for this method, ages have been calculated and found to be close to 10^{10} years, which is about twice the reported age of stone meteorites, and also higher than the supposed age of the universe. ***R. W. Stoenner and J. Zähringer.*** *Geochimica et Cosmochimica Acta,* v. 15, nos. 1-2, Nov. 1958, p. 40-50.

2945* The Isotopic Composition of Rocks of the Earth and of Meteorites. Applies the use of isotopes as an excellent method in geochemistry. ***A. P. Vinogradov.*** *Geochimica et Cosmochimica Acta,* v. 15, nos. 1-2, Nov. 1958, p. 80-90 + 1 plate.

2946 Geology of the Great Lakes. Presents in a non-technical manner the physical characteristics of the lakes and the processes operating in them, the early geological history of the region, and summarizes the events which led to the formation of the lakes. ***Jack L. Hough.*** 313 pp. 1958. University of Illinois Press, Urbana. (QE78 H81g)

2947* On the Chemical Composition of the Outer Core. The average composition of the earth is assumed to be the same as that of the chondritic meteorites. This assumption is consistent with the present rate of heat production within. ***Gordon J. F. MacDonald and Leon Knopoff.*** *Geophysical Journal,* v. 1, no. 4, Dec. 1958, p. 284-297.

2948* Determination of the Earth's Gravitational Potential From Observations on Sputnik 2 (1957 β). Comparison of the value of c^{-1} with that deduced from the constant of precession indicates that the Earth is not in a hydrostatic state. ***A. H. Cook.*** *Geophysical Journal,* v. 1, no. 4, Dec. 1958, p. 341-345.

2949* Gravel Packing Controls Unconsolidated Sand in Venezuela Field. ***Preston S. McReynolds.*** *Journal of Petroleum Technology*, v. 10, Dec. 1958, p. 21-24.

2950 Auroral Effects on Northern Communications. Operations in the polar regions are focusing increased interest on studies of auroral phenomena. ***A. M. Peterson.*** *Military Electronics*, v. 5, Dec. 1958, p. 6-9.

2951* Freezing for Shaft Sinking. Compares freezing and grouting for ground stabilization in areas where unconsolidated, water-bearing formations are encountered. ***Joseph B. Cummings, Russell G. Haworth, Frank C. Pickard, and Gilbert H. Duby.*** *Mining Congress Journal*, v. 44, Dec. 1958, p. 52-56.

2952* Daily Weather Maps as Illustrations of Weather Types. Presents analysis of several typical weather maps. ***Jack Richard Villmow.*** *Ohio Journal of Science*, v. 58, no. 6, Nov. 1958, p. 335-342.

2953 Get Better Completions With Modern Drill-Stem Testing. New tools and correct procedure lead to success in new wells and workovers. ***W. B. Bleakley.*** *Oil and Gas Journal*, v. 56, no. 51, Dec. 22, 1958, p. 58-63.

2954 Chemicals in Drilling Mud. Includes: why drilling fluids are used; composition of drilling fluids; clays; lost-circulation materials; dispersing agents; chemicals to counteract contaminants; products for special application; oil-base drilling fluids; and future application for chemicals. ***George R. Gray.*** *Oil and Gas Journal*, v. 56, no. 5, Dec. 15, 1958, p. 90-98.

2955 Some Measurements of Atmospheric Neutrons. A series of airplane flights carrying neutron counters to an altitude of 700 g cm^{-2} was made at 52°20′ north geomagnetic latitude in 1955. Enriched and normal BF_3 counters were covered with Cd, Sn, Pyrex, and lime-glass shields. ***John D. Gabbe.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 497-502.

2956 Use of Hard Metals in Mining. (*In German.*) Einiges über die Hartmetalle im Bergbau. ***F. Kolbl.*** *Planseeberichte für Pulvermetallurgie*, v. 6, no. 1, Apr. 1958, p. 22-26.

2957 Weather Forecasting. I. Historical. Covers utilization of modern devices. ***R. G. Veryard.*** *Research*, v. 11, Dec. 1958, p. 455-460.

2958* On the Motion of Artificial Satellites Taking Into Account the Resistance of the Medium. ***M. M. Nitã.*** *Revue de Mécanique Appliquée*, v. 3, no. 1, 1958, p. 57-76.

2959* The Determination of the Extent of Fracture of Rock Faces by Sonic Means. Two sonic pulse methods, suitable for the determination of the state of fracture of a rock face, are described. ***M. E. Szendrei and J. P. A. Lochner.*** *South African Institute of Mining and Metallurgy, Journal*, v. 59, no. 4, Nov. 1958, p. 202-214.

2960 Project Prairie Grass, A Field Program in Diffusion. A program designed to provide experimental data on the diffusion of a tracer gas over a range of 800 meters. ***Morton L. Barad, editor.*** *U. S. Air Force, Cambridge Research Center, Geophysical Research Papers No.* 59, v. I-II, July 1958, 280 and 209 pp. (QC806 Un3.2g Vis.)

2961* The Cryptomelane and Jaspilite Deposits of Corumbá, Mato Grosso State, Brazil. Position of the deposit and structure of the surrounding geographical strata; Mn ores and Fe ores, historical survey of the mining works. Geological formation of the deposits. (*In German.*) Die Kryptomelan- und Jaspilit-Lagerstätten von Corumbá im Staate Mato Grosso, Brasilien. ***Hannfrit Putzer.*** *Zeitschrift für Erzbergbau und Metallhüttenwesen*, v. 11, Nov. 1958, p. 527-538.

GRAPHIC ARTS

2962* Graphic Science and Technology in the Soviet Union. I. A tour of Russian establishments, including the Graphic Arts Research Institute in Moscow. ***Andries Voet.*** *American Ink Maker*, v. 36, Dec. 1958, p. 32 + 4 pages.

2963* Photogrammetric Mapping of High Bluffs. ***Claude W. Waggoner.*** *Civil Engineering*, v. 28, no. 12, Dec. 1958, p. 73-75.

2964* Photographic Properties of Silver Tungstate and Silver Molybdate Emulsions. The emulsions were prepared in a gelatin solution and spectral sensitivity, capacity for development, and sensitivity to light or to gamma rays were determined. (*In Japanese.*) ***Yoshitada Tomoda, Nobuya Nakamura, and Masami Kawaski.*** *Government Chemical Industrial Research Institute, Tokyo, Reports*, v. 53, July 1958, p. 261-268.

2965* New Combustible for Photoflash Lamps. New zirconium photoflash lamps are described along with their performance characteristics including light output, timing, color, temperature, and reflector efficiency. ***L. F. Anderson.*** *Illuminating Engineering*, v. 53, Dec. 1958, p. 657-663.

2966* Significant Trends for Printing Production. The impact of new developments on the industry are considered. The author emphasizes that the graphic arts industry is not investing the percentage of the sales dollar in research that it should. A major portion of the research and development tab in the printing industry is being picked up by customers and by equipment and supply manufacturers. To achieve the optimum results from research efforts for all units of the industry, graphic arts management must include a research investment in future budgets. ***J. Homer Winkler.*** *Photoengravers Bulletin*, v. 48, no. 5, Dec. 1958, p. 11-16.

2967* Internal Gelatin in Photographic Silver Halide Grains. Three analytical methods are described for the determination of "internal gelatin" in photographic silver halide grains. By the use of these methods, it is shown that photographic silver halide grains contain from 20 to 50 ppm of internal gelatin. There appears to be no real difference between the various halide types with respect to internal gelatin content. ***A. E. Ballard, C. W. Zuehlke, and R. S. Miller.*** *Photographic Science and Engineering*, v. 2, no. 4, Dec. 1958, p. 186-190.

2968* On the Minimum Energy Detectable by Photographic Materials. II. Results for Four Current Kodak Films. III. Energy Incident on a Microscopic Area of the Film. Data are given on the energy detectivity and contrast detectivity of four current Eastman Kodak films: Royal-X, Tri-X, Plus-X, and Panatomic-X. ***R. Clark Jones.*** *Photographic Science and Engineering*, v. 2, no. 4, Dec. 1958, p. 191-204.

2969* Analysis of the Variability Among Density-Log Exposure Curves of Black-and-White Negative Films by the Method of Principal Components. It is shown that the *D*-log *E* characteristic curves of a wide variety of black-and-white negative films vary from the mean of these curves in only four basically different ways. A complete description of the shape of any of the characteristic curves can be given by four numbers, which are the amounts of each of the four component types of variability which combine to produce the shape differences between the sample curve and the mean curve. ***J. L. Simonds.*** *Photographic Science and Engineering*, v. 2, no. 4, Dec. 1958, p. 205-209.

2970* System Analysis and Performance of a Feedback Scanning Printer. Contact printing is carried out by means of a moving spot of light optically projected from the face of a cathode-ray tube onto the printing plane. The spot intensity is instantaneously varied in accordance with local densities of the negative in such a way that a wide-range, linear compression of effective density scale in the negative is obtained. The electrical transfer characteristics are discussed and their performance is analyzed in equivalent photographic terms. ***L. L. Blackmer and J. C. Marchant.*** *Photographic Science and Engineering*, v. 2, no. 4, Dec. 1958, p. 225-230.

2971 International-Wattier Gravure Process. A step-by-step description of the process. *Productionwise*, v. 12, no. 5, Dec. 1958, p. 20-23.

2972* New Methods and Devices for Checking Motion Picture Cameras. Schemes and operation of highly efficient universal collimators and autocollimators, and methods of testing motion picture equipment using these devices. (*In Russian.*) Novye metody i pribory dlia proverki kinos'emochnykh ap-

paratov. ***O. I. Reznikо.*** *Tekhnika Kino i Televideniia*, 1958, no. 11, Nov., p. 62-65.

2973* Relationship Between the Structure of Silver Bromide Grains and the Sensitivity of Photographic Emulsions. Evaluation of the sizes of the coherent lattice spaces by means of precision measurements of the half-width of the Debye-Scherrer lines of photographic emulsion grains. Inverse ratio of sensitivity and space size. The internal latent picture is produced on "internal surfaces" forming the limits of the homogeneous lattice spaces. Inside an undisturbed AgBr lattice there is no place for a growing center. (*In German.*) Zusammenhang zwischen der Struktur der Silberbromid-Körner und der Empfindlichkeit photographischer Emulsionen. ***Wilhelm Waidelich.*** *Zeitschrift für Angewandte Physik*, v. 10, no. 11, Nov. 1958, p. 525-531.

HEAT POWER

2974 Ramjets for Supersonic Airliners. Ramjet efficiency and hypersonic developments are covered. *Aeroplane*, v. 95, Dec. 12, 1958, p. 872-873.

2975* Manifold Tuning. Is best suited to fuel-injection engines with individual manifold pipes, because of the clean design of induction piping that is possible with fuel injection systems. Manifolds used currently on practically all quantity-produced engines are too complex in shape. ***E. M. Goodger and J. Hillsdon.*** *Automobile Engineer*, v. 48, Dec. 1958, p. 519-523.

2976 Turbojet Noise Suppression. II. Designers Weigh Quiet vs. Cost Penalty. British accomplishments are surveyed. ***David A. Anderton.*** *Aviation Week*, v. 70, Jan. 5, 1959, p. 55 + 4 pages.

2977 New Aids to Find Shellside Heat Transfer Coefficient and Pressure Drop for Water. Short-cut heat-exchanger calculations for segmental baffled, tubular heat exchangers. ***Ning Hsing Chen.*** *Chemical Engineering*, v. 65, Dec. 1, 1958, p. 117-118.

2978 Evolution of the Boiler Feed-Pump Drive. The horizontal-duplex feed pump, introduced as a drive separated from the main engine so that water could be fed to the boilers when a ship was docked, has been adapted to large land installations for steam turbine-generators. ***R. A. Baker.*** *Combustion*, v. 30, no. 6, Dec. 1958, p. 34-37.

2979 Steam for 550 MW. Design of a new British installation. *Engineering*, v. 186, Nov. 28, 1958, p. 710-711.

2980* Sulzer-Engined Main-Line Diesel-Electric Locomotives. A total of 144 six-cylinder engines to be built by Vickers-Armstrongs (Engineers) Ltd. *Gas and Oil Power*, v. 53, Nov. 1958, p. 288-292.

2981* Production of Sulzer-Type Locomotive Engines at Barrow-in-Furness. A number of recent modifications to the Sulzer LDA28 engine are discussed. *Gas and Oil Power*, v. 53, Nov. 1958, p. 302-306.

2982 Combustion—An Aeronautical Science. The basic sciences which are essential to an understanding of combustion are briefly presented and their present limitations are noted. ***Howard W. Emmons.*** *Journal of the Aero/Space Sciences*, v. 25, Dec. 1958, p. 730-741.

2983* Combining the Gas-Turbine and Steam Turbine. Combustion for the gas turbine also provides heat energy for steam generation. In effect, the steam plant fits between the gas turbine's compressor and turbine units. ***A. O. White.*** *Mechanical Engineering*, v. 80, Dec. 1958, p. 48-53.

2984* Engine Noise and Noise Suppression. Sources of noise; sound barriers; sound-reducing enclosures. *Oil Engine and Gas Turbine*, v. 26, Dec. 1958, p. 304-307.

2985* Corrugated Suppressor Reduces DC-8 Noise. A corrugated suppressor followed by an ejector equipped with a target-type thrust brake supplies 9-13 db noise suppression and better than 40% reverse thrust in Douglas' new DC-8 jet transport. ***L. R. Jordan and C. M. Auble.*** *SAE Journal*, v. 66, Dec. 1958, p. 49-52.

2986* Multifuel Engines. Engines have proved practical for future production. *SAE Journal*, v. 66, Dec. 1958, p. 70-71.

2987* Superchargers Up Power, Cut Fuel Use in Free-Piston Engines. Supercharging as a means of increasing power and reducing part-load fuel consumption. ***H. G. Spier.*** *SAE Journal*, v. 66, Dec. 1958, p. 110 + 1 page.

2988* Rocket Throttling: Tricky But Not Impossible. Designing rocket engines for variable thrust. No conclusive answer has been found yet. ***Kurt R. Stehling.*** *Space/Aeronautics*, v. 30, no. 6, Dec. 1958, p. 66-71.

See also: **2926** (multifuel engines); **3020** (balancing 4-cycle engines).

INFORMATION—PREPARATION AND DISSEMINATION

2989 ASM-SLA Metallurgical Literature Classification. Many headings have been revised by ASM Committee on Literature Classification with the cooperation of the Italian Association of Metallurgy, acting as spokesman for several European groups. 2nd Ed. 74 pp. 1958. American Society for Metals, Cleveland.

2990 The Chemical and Related Literature of Belgium. ***Kurt Gingold.*** *Journal of Chemical Education*, v. 35, Dec. 1958, p. 619-623.

2991 Five Steps to Faster Reading. I. *Product Engineering*, v. 30, no. 1, Jan. 5, 1959, p. 29.

2992* Periodical Indexing Workshop. Four papers on indexing *Business Week*, McGraw-Hill journals, and general and popular magazines. Indexing services. ***Rose Boots.*** *Special Libraries*, v. 49, no. 10, Dec. 1958, p. 459-474.

INSTRUMENTATION

2993* Using Silver Chloride Crystals in Infrared Spectrography. Silver chloride is not soluble in water, is not attacked by strong acid, is suitable for the qualitative or quantitative analysis in aqueous medium of mineral or organic substances, has a very wide IR investigation range, especially below 9μ. Disadvantages are its high refraction index, malleability, and its reduction through contact with metals other than Ag. Perfectly flat transparent optical plates were obtained. (*In French.*) Utilisation des cristaux de chlorure d'argent en spectrographie infrarouge. ***M. Le Sech.*** *Chimie Analytique*, v. 40, Nov. 1958, p. 425-429.

2994* A Method for Rapid Fractionation of Particulate Systems by Gradient Differential Centrifugation. Simple and rapid method for obtaining relatively uncontaminated preparations of particulate cell components by gradient differential centrifugation, in quantities sufficient for further subfractionation. The method depends on the use of a centrifuge distribution head that allows rapid construction of liquid density gradients. ***J. F. Albright and N. G. Anderson.*** *Experimental Cell Research*, v. 15, no. 2, Oct. 1958, p. 271-281.

2995 The Determination of the Particle Size of Thoria in the Range 5-0·1μ by the Radiometric Sedimentometer. Methods of particle size analysis which are applicable to thoria powders are briefly reviewed and a new method is proposed. In this, thoria is dispersed in a dilute Calgon solution and neutron-irradiated for a few seconds to produce ^{234}Th. An aliquot of the active dispersed phase is placed on the top of a column of aqueous sucrose solution and the mass of thoria deposited after various centrifuging periods is determined by

β-counting through the base of the tube, and from these data a size analysis is obtained. The method is very fast and simple to operate and comparison with the two other centrifugal methods shows excellent agreement. A size analysis of another suitable material, silica, is also demonstrated. ***P. Connor, W. H. Hardwick, and B. J. Laundy.*** *Journal of Applied Chemistry*, v. 8, pt. 11, Nov. 1958, p. 716-728.

2996* Measurement of Melting Point or Flow Temperature of Polymers With an Automatic Melting Point Apparatus. A melting point apparatus is described which is easy to handle and fully automatic; it is a potentially useful instrument both for the plastics and the organic chemistry laboratory. It is intended to measure the melting point of crystalline micro- and macromolecular materials, or to give immediate information on the flow properties of polymeric substances; the instrument may be calibrated to give curves from which the molecular weight can be estimated. (*In German.*) Die Messung des Schmelzpunktes oder der Fliesstemperatur von Polymeren mit einem Schmelzpunktautografen. ***Kurt Ueberreiter and Hans-Joachim Orthmann.*** *Kunststoffe*, v. 48, Nov. 1958, p. 525 + 5 pages.

2997 A Prolate Spheroidal Field Magnetic Spectrometer With Source Near the Equatorial Plane. A prolate spheroidal field β-spectrometer is described in which the source and detector are located on the same side of the focal ring slit. The trajectories reach distances of up to 38 cm from the axis and the ring slit has a radius of 33 cm. The relation between the resolution and transmission has been measured for four source diameters. Using a scintillation detector of 1.85 cm. diameter and 1 cm. length, a resolution W of 1.28% at a transmission T of 1% of 4π has been found for a source of 1 cm. diameter. For a 1 mm. source the measured values range from $W = 0.4\%$ at $T = 0.8\%$ to $W = 1.52\%$ at $T = 5.2\%$. ***P. R. Evans, N. J. Freeman, G. K. McGinty, B. H. Armitage, and H. O. W. Richardson.*** *Physical Society, Proceedings*, v. 72, Dec. 1958, p. 949-958.

2998* Applications of a Continuous Process Ultraviolet Analyser. For an advanced concept of process automation, these analyzers have been successfully used in closed loop control. ***D. J. Fraade.*** *Process Control and Automation*, v. 5, Dec. 1958, p. 516-518.

2999* Machines Bellows Are Light, Resist Fatigue. Bellows machined from solid bar stock may provide units that can take temperature extremes and for which new materials can be used. *Space/Aeronautics*, v. 30, no. 6, Dec. 1958, p. 60 + 4 pages.

3000* Determining Specific Surface and Volume of Voids in Porous Substances. Different methods were applied to determine the specific surface of a standard preparation of silica gel subjected to extended physical and chemical investigations. These methods were the following: evaluation with nitrogen, or with water, as absorbates; calculation of the surface based on volume of voids and average effective pore radius; calculation of the surface by determining the free enthalpy of the surface. The results of these different methods are compared. (*In German.*) Zur Bestimmung der spezifischen Oberfläche und des Porenvolumens poröser Stoffe. ***G. Kämpf and H. W. Kohlschütter.*** *Zeitschrift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie*, v. 62, no. 9, 1958, p. 958-965.

3001* The Galvanic Thermoelement: The Thermocouple. Extends theory of isothermal polyphase electrochemical systems to non-isothermal systems, including the galvanic thermoelement with the simple and special case of a thermoelement consisting exclusively of two metals. (*In German.*) Die galvanische Thermozelle; die Thermokette. ***E. Lange.*** *Zeitschrift für Physikalische Chemie* (Leipzig), v. 209, nos. 3-4, Aug. 1958, p. 162-178.

3002* Regular and Diffuse Reflection of Powders and Its Dependence Upon Grain Size. By increasing the reflection spectrum between crossed polarization windows it is possible to separate the diffusion part from the total reflection. Diffuse reflection of materials with low absorption is shown to be greatly dependent, and that of materials with high absorption to be independent, upon grain size. (*In German.*) Über reguläre und diffuse Reflexion an Pulvern und ihre Abhängigkeit von der Korngrösse. ***G. Kortüm and J. Vogel.*** *Zeitschrift für Physikalische Chemie* (Neue Folge), v. 18, nos. 3/4, Nov. 1958, p. 230-241.

LUBRICATION AND FRICTION

3003* Hydrodynamic Lubrication of Ball and Socket Joints. As a step towards formation of design rules for ball and socket joints, a solution of the lubrication equations for an "ideal" joint under steady loading and rotation is presented. The friction for the ball is found to be higher, and the load capacity lower, than that of a plain bearing under similar conditions. ***R. I. Tanner.*** *Applied Scientific Research, Sec. A, Mechanics, Heat, Chemical Engineering, Mathematical Methods*, v. 8, no. 1, 1958, p. 45-51.

3004* Mounting Anti-Friction Bearings. A study of the reduction of diametric clearance in bearings mounted with an interference fit. *Automobile Engineer*, v. 48, Dec. 1958, p. 515-518.

3005* On Critical Speeds Induced by Ball Bearings at Lower Rotating Speeds. When single-row radial ball bearings are used, several critical speeds may take place in a vertical shaft at certain rotating speeds lower than the major critical speed. When the bearing center line of both bearing pedestals is not in alignment and the shaft is not in a perfectly straight line, there is the possibility that these critical speeds occur. When self-aligning double-row ball bearings are used, these critical speeds do not occur; they occur only in the shaft supported by single-row radial ball bearings. ***Toshio Yamamoto.*** *Bulletin of JSME*, v. 1, no. 3, Aug. 1958, p. 240-244.

3006* Lubricants on Molybdenum Sulfide Base. Specific advantages of MoS_2 lubricants based on its layer structure. Application at low or high temperature and high pressure as well as under extraordinary atmospheric conditions. (*In German.*) Schmierstoffe auf der Basis von Molybdändisulfid. ***E. Tschanter.*** *Chemiker-Zeitung*, v. 82, no. 22, Nov. 25, 1958, p. 799-802.

3007 The Acceleration of Pitting Failure by Water in the Lubricant. The effect of water content of the lubricant on the incidence of pitting type failure of ball bearings was studied using the four ball rolling test. Several oils of different characteristics which are being used for the lubrication of ball bearings in practice were tested under four conditions of water content. The presence of water in the lubricant accelerated the pitting failure of balls made of conventional EN.31 steel, but had no effect on the pitting failure of stainless steel balls. ***L. Grunberg and D. Scott.*** *Institute of Petroleum, Journal*, v. 44, Nov. 1958, p. 406-410.

3008* Lubricant Filter Tests. Compares three methods of filtration which can be employed in automotive engines. *Oil Engine and Gas Turbine*, v. 26, Dec. 1958, p. 311-312.

3009* How ANP Turbine Lubricants Behave Under High-Level Radiation. Radiation can produce almost instantaneous failure of modern aircraft lubricants. ***John M. Clark, Jr. and George C. Lawrason.*** *SAE Journal*, v. 66, Dec. 1958, p. 77-78.

See also: **3214** (manufacture of ball and roller bearings).

MECHANICAL ENGINEERING

3010 Fixtures for Testing Pin-End Columns. Design and the performance of column end fixtures with cylindrical bearing surfaces. These fixtures were designed for heavy loads (maximum 2,000,000 lb.) and simulate a pin-end condition in one direction and fixed-end condition in the direction at right angles to the first. The fixtures can be used for axial or eccentric column tests with equal end eccentricities. ***A. W. Huber.*** *ASTM Bulletin*, no. 234, Dec. 1958, p. 41-45.

3011 Effects of Local Loadings on Pressurized Circular Cylindrical Shells. An analysis of stresses and deflections for four types of loading. ***Bertram Klein.*** *Aircraft Engineering*, v. 30, Dec. 1958, p. 356-361.

3012 Matrix Methods for Framework Analysis. Analysis of pin-jointed, redundant frameworks by matrix methods using an electronic computer. ***H. Watson.*** *Aircraft Engineering*, v. 30, Dec. 1958, p. 362-366.

3013* Cam and Tool Design. VIII. Completing the Layout. ***Oscar T. Lippman.*** *Automatic Machining*, v. 20, no. 2, Dec. 1958, p. 54-57.

3014* Stresses in a Circular Disk With an Eccentric Circular Hole Under Radial Forces. A theoretical solution of a disk with an eccentric circular hole when it is compressed by two equal and opposite forces acting at a radius of the outer circle on the center of inner circle. The method of solution adds to the given stress system a suitable biharmonic function, which gives no normal and tangential stress on the outer edge. The parametric coefficients involved in the solution are adjusted so as to satisfy the boundary conditions at the inner edge. Bipolar coordinates are used in the solution, by means of which explicit expressions are obtained for the parametric coefficients. Formulas of stress along the edge of circles are derived, and, in particular, the stress distributions of the inner hole are calculated. ***Kazyu Miyao.*** *Bulletin of JSME*, v. 1, no. 3, Aug. 1958, p. 195-198.

3015* Effect of the Weight of Beam on the Measurement of Young's Modulus by Lateral Vibration of Cantilevers. The frequencies of the fundamental and second modes of lateral vibration of a cantilever beam under the action of its own weight are determined approximately by using the Galerkin method. The corrected formulas for calculating the Young's modulus of the beam material are derived from these solutions. The experimental results for the fundamental mode of vibration of cantilevers are presented. It is shown that Young's modulus of the material can be obtained exactly by treating the experimental data with the corrected equation. An expedient to predict the amount of the effect of weight on the given specimen is proposed. ***Kiichi Sato.*** *Bulletin of JSME*, v. 1, no. 3, Aug. 1958, p. 205-209.

3016* Vibration of a Corrugated Diaphragm. By analyzing the vibration properties of the corrugated diaphragm under the same assumptions as the static case, obtains approximate formulas for the natural frequencies of symmetric and asymmetric modes including the effect of concentrated mass. Effects of initial tension and concentrated mass on natural frequencies are derived by the energy method. ***Takashi Akasaka and Toshio Takagishi.*** *Bulletin of JSME*, v. 1, no. 3, Aug. 1958, p. 215-221.

3017* Study of Three-Dimensional Internal Flow in Impellers of Centrifugal Blowers With Straight-Radial Blades and Logarithmic-Spiral Blades in Radial Part Only. The flow distribution in the passages of a rotating impeller was studied on two types of impellers, one with straight-radial blades, and the other with logarithmic-spiral blades; the results are presented in the form of relative velocity and direction of flow. ***Kunio Fujie.*** *Bulletin of JSME*, v. 1, no. 3, Aug. 1958, p. 275-282.

3018* Vibration of Water Turbine When Air Is Admitted to Its Draft Tube. (Experimental Study). The severe vibrations in the draft tube can be eliminated or greatly reduced by the admission of air into the tube, but unless just the right amount of air is admitted, instead of reducing vibration, a large amount of draft head is lost, and vibrations are increased. To verify this fact, models of draft tubes were used. Relations between amplitude of vibration, flow ratio of air to water, draft tube efficiency, and ratio of circulatory component to axial component of water were obtained. ***Mitsukiyo Murakami.*** *Bulletin of JSME*, v. 1, no. 3, Aug. 1958, p. 298-304.

3019 The Response of a Loaded Hydraulic Servomechanism. Derivation of the values of $f(L)$ for no-load, constant load, spring, viscous, orifice and inertial loads. ***D. E. Turnbull.*** *Chartered Mechanical Engineer*, v. 5, no. 10, Dec. 1958, p. 480-482.

3020 Balancing of High-Speed 4-Stroke Cycle Engines. Balancing the rotating and reciprocating components of high-speed engines to minimize external and internal force and to avoid excessive vibration of the engine and its surroundings as well as undesirable fluctuating loads on the engine and its mounting structure. ***R. Clink.*** *Chartered Mechanical Engineer*, v. 5, no. 10, Dec. 1958, p. 485-486.

3021* Circular Columns Analyzed by "Cracked-Section" Method. Design of reinforced concrete columns. Presents a few curves that are useful in applying the American Concrete Institute code to a circular column in which the reinforcing steel is arranged in a circle. ***Harrison Kane and Joseph H. Moore.*** *Civil Engineering*, v. 28, Dec. 1958, p. 76-77.

3022 Stresses Produced in a Half Plane by Moving Loads. A study is made of stresses and displacements induced in an elastic half plane (plane strain) by a concentrated line load moving at a constant speed along its surface. The stress field for an arbitrary load distribution can be built up by superposition of these concentrated-load solutions. Three cases are considered: (a) The load is moving more slowly than either the longitudinal or transversal wave speeds of the elastic medium (subsonic case). (b) The load speed is between the two wave speeds (transonic case). (c) The load speed is greater than either wave speed (supersonic case). In each of these cases the nature of the singularity caused by the load is examined and the complete solution is given. ***J. Cole and J. Huth.*** *Journal of Applied Mechanics*, v. 25, no. 4, Dec. 1958, p. 433-436.

3023 A Refined Theory of Elastic, Orthotropic Plates. The theory includes the effect of transverse shear deformation and normal stress and may be considered a generalization of the classical theory of von Karman modified by the refinements of the Levy-Reissner-Mindlin theories. A nonlinear system of equations is derived directly from the corresponding equations of the three-dimensional theory of elasticity in which body-force terms have been retained. Next, the system of equations is linearized and reduced to a single sixth-order partial differential equation in a stress function. A Levy-type solution of this equation is discussed. ***S. J. Medwadowski.*** *Journal of Applied Mechanics*, v. 25, no. 4, Dec 1958, p. 437-443.

3024 Large Deflection of Stiffened Plates. The problem of nonlinear deflection of orthogonally stiffened plates subjected to static lateral load is treated using the concept of equivalent orthotropic plates. Equations are derived which are the appropriate generalizations of von Karman's equations for isotropic plates. Rectangular plates are considered in detail, and an approximate solution is obtained through trigonometric series. The solution allows for rotational constraint along the plate boundary. All cases from simple support to complete fixity of boundary can therefore be treated. ***W. G. Soper.*** *Journal of Applied Mechanics*, v. 25, no. 4, Dec. 1958, p. 444-448.

3025 Large Symmetric Deflections of Annular Plates. Presents a series solution of the von Karman equations for axially symmetric deflections of annular plates. A numerical procedure is described for evaluating the coefficients in the series. Results obtained by this procedure are given for a plate subjected to axial edge loads. A method is presented for demonstrating convergence and appraising the errors. ***G. A. Wempner and R. Schmidt.*** *Journal of Applied Mechanics*, v. 25, no. 4, Dec. 1958, p. 449-452.

3026 The Flexure of a Uniformly Pressurized, Circular, Cylindrical Shell. Presents the moment-curvature relationship and the components of displacement in the cross section of a uniformly pressurized, long, closed, circular, cylindrical shell. The shell is loaded in one of its principal planes by two equal and opposite terminal couples: First, the shell undergoes small initial displacements. These are formed by superimposing pressurization displacements upon Saint Venant displacements. Second, from this deformed position the shell is perturbed into a system of additional small displacements. A Rayleigh-Ritz technique is used to find the latter displacements from the theorem of minimum potential energy. The point at which the moment-curvature relationship becomes nonlinear is shown by several curves. ***J. D. Wood.*** *Journal of Applied Mechanics*, v. 25, no. 4, Dec. 1958, p. 453-458.

3027 Design of Accelerometers for Transient Measurements. Study to find a significant accelerometer accuracy criterion for measuring transients, and to apply it to the investigation of optimum damping and the range of frequency response required. It is proposed that the effect of instrument distortions on the response spectrum of a transient be used to evaluate the acceptability of the measurement. The application of this response-spectrum criterion to some selected acceleration pulses indicates that the optimum instrument damping for a transient measurement is essentially the same as for the measurement of periodic motions and that the accelerometer period should be less than 0.4 of the pulse duration for 5% accuracy. ***Sheldon Rubin.*** *Journal of Applied Mechanics*, v. 25, no. 4, Dec. 1958, p. 509-514.

3028 Physical Properties of Plastics for Photothermoelastic Investigations. The optical and physical properties of Paraplex P43, Castolite, and epoxy resin Hysol 6000-OP, which are potentially of interest in photothermoelastic investigations, were investigated over a temperature range from +100 to −60 F. Results on the thermal-expansion coefficient, the material fringe value, and the modulus of elasticity as functions of temperature are presented. ***H. Tramposch and G. Gerard.*** *Journal of Applied Mechanics*, v. 25, no. 4, Dec. 1958, p. 525-528.

3029 The Stresses in a Thick Cylinder Having a Square Hole Under Concentrated Loading. Contains a solution for the stress distribution in a thick cylinder having a square hole with rounded corners under the condition of concentrated loading. The problem is investigated by the complex-variable method, associated with the names of N. I. Muskhelishvili. The unknown coefficients included in the solution are determined by the method of perturbation. Numerical examples of the solution are worked out and compared with available results. ***Masaichiro Seika.*** *Journal of Applied Mechanics*, v. 25, no. 4, Dec. 1958, p. 571-574.

3030 Elastic, Plastic Stresses in Free Plate With Periodically Varying Surface Temperature. Deals with a free plate that consists of an elastic, perfectly plastic material and is subjected to a harmonically varying temperature at one face, while the other face is kept at a constant temperature and the edge is perfectly insulated. The thermal stresses associated with the steady-state temperature oscillations are analyzed, and the development of plastic regions is discussed. ***Halil Yüksel.*** *Journal of Applied Mechanics*, v. 25, no. 4, Dec. 1958, p. 603-606.

3031* On the Operating Condition of an Automobile Shock Absorber. Comparison tests of various types of shock absorbers. When a double acting type shock absorber is used, a degenerative curve should be taken for the bound side damping force. ***Katsumi Hashikura, Tsuyoshi Sugimoto, Hiroshi Kuriyama, and Hisao Sakurai.*** *Journal of Mechanical Laboratory of Japan*, v. 4, no. 1, 1958, p. 28-34.

3032* Plastic Yielding of Single Notched Bars Due to Bending. A general method is developed to evaluate the constraint factor of single notched bars subjected to pure bending under conditions of plane strain. Upper and lower bounds for the yield moment are obtained. Bounds for the constraint factor are calculated for (a) rectangularly, (b) trapezoidally, and (c) V-notched bars with circular fillets. The theory is checked experimentally for both the over-all yield loads and the actual stress distribution, for the above shapes and for circular and V-notches for which Green has worked out an upper bound solution. A new technique to obtain slip-line fields experimentally is also developed. ***G. Lianis and H. Ford.*** *Journal of the Mechanics and Physics of Solids*, v. 7, no. 1, Nov. 1958, p. 1-21 + 1 plate.

3033* On the Use of Linearized Yield Conditions for Combined Stresses in Beams. Yield criteria expressed in terms of stress resultants are obtained for typical engineering structures, using the first fundamental theorem of limit analysis. These yield criteria, which are often non-linear, are then replaced by inscribed piecewise linear approximations. The complete solutions based on these approximate yield criteria provide lower bounds; the corresponding values for the upper bound can be obtained by multiplying the lower bound values by a suitable factor. A few examples are worked out to illustrate the simplicity achieved in determining the collapse load. ***R. Sankaranarayanan and P. G. Hodge, Jr.*** *Journal of the Mechanics and Physics of Solids*, v. 7, no. 1, Nov. 1958, p. 22-36.

3034* Analysis of Shells of Revolution Composed of Workhardening Material. The yield criterion and its dependence on the strain-history are determined in terms of stress resultants of the shell and the rates of extension and curvature of the middle surface. The nature of the mathematical problem that arises in the analysis of work-hardening shells is discussed. Incipient plastic deformation of a cylindrical shell is treated as an example. The uniqueness of the incipient velocity field is discussed and the dependence of the velocity rates on the rate of surface tractions is established for a simple case. ***E. T. Onat.*** *Journal of the Mechanics and Physics of Solids*, v. 7, no. 1, Nov. 1958, p. 45-59.

3035* On the Strength of Classical Fibres and Fibre Bundles. Discusses tensile strength distributions for fibers whose strength is independent of the rate of loading. Reasons are presented for expecting that the tensile strength should obey the Weibull distribution. The statistical theory of the strength of bundles of these fibres, as developed by Daniels, is applied to infinite bundles composed of fibres which obey the Weibull distribution. It is found that the ratio of the tensile strength (units of force at break per initial unit area) of a bundle to the mean tensile strength of the constituent filaments decreases montonically with increasing disperion in the strength of the constituent filaments. ***B. D. Coleman.*** *Journal of the Mechanics and Physics of Solids*, v. 7, no. 1, Nov. 1958, p. 60-70.

3036 Designing Bonded Rubber Assemblies. Covers advantages of bonding, types of rubber-base adhesives, joint design, and bonding methods. ***R. K. Humke.*** *Machine Design*, v. 30, Dec. 11, 1958, p. 124-129.

3037 Gear Calculations Simplified by the Use of Williamson Tables. Tables and formulas for calculating involute gear-tooth elements. ***C. A. Underwood.*** *Machinery (London)*, v. 93, Dec. 17, 1958, p. 1416-1420.

3038* Selecting Hydraulic Power Equipment. Shows how reliability and safety can be built into fluid power circuits to give optimum performance. ***H. L. Stewart.*** *Tool Engineer*, v. 42, no. 1, Jan. 1958, p. 86-90.

METALLURGY

3039* The Properties of a New Type of Aluminum Bronze Containing Manganese. Description of microstructural and mechanical characteristics of a complex aluminum bronze containing an elevated percentage of manganese. This bronze has a high tensile strength and a considerable resistance to erosion and corrosion, in particular to diluted and unaerated H_2SO_4 solutions and sea water. (*In Italian.*) Caratteristiche di un nuovo tipo di bronzo di alluminio al manganese. ***C. Panseri and M. Leoni.*** *Alluminio*, v. 27, no. 11, Nov. 1958, p. 481-493.

3040 High-Temperature Metals. Principles of selection, alloys available, and high-temperature behavior. ***E. Skinner.*** *Chemical Engineering*, v. 65, Dec. 15, 1958, p. 137-147.

3041 Designing With Stainless Steel. Properties and applications of stainless steel as used in equipment design. *Electrical Manufacturing*, v. 62, Dec. 1958, p. 79-86.

3042 Fifty Years' Progress in Non-Ferrous Metals Technology. A review is given of some of the most important advances made during the last 50 years in the fields of smelting and refining, melting and casting, rolling, wire drawing, tube drawing, extrusion; forging, thermal treatment, and inspection and control. ***G. L. Bailey.*** *Institute of Metals, Journal*, v. 87, pt. 4, Dec. 1958, p. 97-111.

3043 The Application of Aluminium to Pressure Vessels. Based on papers covering the materials, codes of practice for construction, fabrication, and user experience of aluminum pressure vessels. *Light Metals*, v. 21, Dec. 1958, p. 375-376.

3044* Manganese Steel in Industry. Principal uses of 11 to 15% manganese steel. Manganese steel is not indispensable, but where long service is valuable it is ultimately more economical than other materials lower in first cost. *Mechanical World and Engineering Record*, v. 138, Dec. 1958, p. 543-544.

3045 Preview of Space Metals. Status of development and future prospects in Al, Mg, steels, Ti, Be, superalloys, refractory metals, ceramics and cermets, graphite, composite materials, sandwich construction, surface treatment and coatings. *Metal Progress*, v. 74, no. 4, Oct. 1958, p. 96-113.

3046 What's New in Everyday Uses for Metals. New applications for Al, stainless steels, ferrous castings, alloy and carbon steels, copper, Mg, nonferrous castings, and cast high alloys. ***J. A. Nock, Jr., et al.*** *Metal Progress*, v. 74, no. 4, Oct. 1958, p. 114-129.

3047 Detroit Revisited. Appraisal of recent metallurgical advances in American automobile manufacturing. ***J. L. McCloud.*** *Metal Progress*, v. 74, no. 4, Oct. 1958, p. 130-133.

3048* Beryllium. Advantageous atomic, radiographic, mechanical properties of Be. Preparation from beryl: a hydroxide is formed, the products are purified, and purified hydroxide is combined to form metallic Be, by magnesothermy or electrolysis. Fabrication processes to obtain rough billets, bars or sheets include melted or sintered Be. High temperature properties. Use of semi-products of Be. Toxicity and control. (*In French.*) Le Béryllium. ***R. Syre.*** *Métaux Corrosion-Industries*, v. 33, Oct. 1958, p. 406-419.

3049 Manganese Joins Aluminum to Give Strong Stainless. Introduces a completely austenitic Al-Mn-C steel that supplies ductility for forming, and strength at high temperatures. ***J. L. Ham and R. E. Cairns, Jr.*** *Product Engineering*, v. 29, no. 52, Dec. 22, 1958, p. 50-51.

3050* Lower Airframe Weights With Heat-Treated Titanium Alloys. Compares Ti alloys properties after heat treatment with their properties in the annealed condition. ***E. F. Erbin.*** *Space/Aeronautics*, v. 30, no 6, Dec. 1958, p. 42-47.

3051 Material Solves Problems in Forging Reactor Parts. Steel is equal in tensile, impact strength, and weldability to ASME Boiler Code analysis SA 302 but does not flake. *Steel*, v. 143, Dec. 22, 1958, p. 72 + 2 pages.

3052* Steel for Reinforced Concrete. Problems concerning quality in reinforcing iron, from a metallurgical and mechanical viewpoint. Relationship between strength and carbon contents in hot-rolled, natural hard bar steel. Production of strength qualities in cold drawn steel and tempered steel. (*In Norwegian.*) Stål til spennbetong. ***Leif Thomas.*** *Teknisk Ukeblad*, v. 105, no. 43, Nov. 20, 1958, p. 1011-1018.

3053 Constitution, Metallurgy, and Oxidation Resistance of Iron-Chromium-Aluminum Alloys. The constitution of Fe-Cr-Al alloys was investigated employing high purity materials. Ternary sections are presented. The physical metallurgy of Fe alloys containing 25 to 35 w/o Cr and 3 to 8 w/o Al was investigated to determine their usefulness as structural materials. The oxidation resistances of Fe-23.7 w/o Cr-6.0 w/o Al alloy and of Ni-20.0 w/o Cr-1.1 w/o Cb alloy were compared at 1900 and 2100 F in air containing additions of water vapor, CO_2 and combinations of water vapor and CO_2. ***Walston Chubb, et al.*** *U. S. Atomic Energy Commission, BMI*-1298, Oct. 16, 1958, 104 pp. (UF767 U3b Contin.)

METALS—CORROSION

3054 Corrosion Embrittlement; the Effect of Cathodically Evolved Hydrogen on Iron and Nickel. Summary and discussion of address presented to Corrosion Group of Society of Chemical Industry. ***Michel Smialowski.*** *Chemistry & Industry*, 1958, no. 45, Nov. 8, p. 1460-1461.

3055 Controlling Corrosion of Offshore Platforms and Some Typical Costs on a Tender-Type Installation. (Adapted from paper "Paint Maintenance".) ***R. M. Robinson.*** *Corrosion*, v. 14, Nov. 1958, p. 93 + 2 pages.

3056 Comparing the Corrosion Resistance of Wrought Iron and Steel. A discussion of the paper "Iron-Silicate Slag Network Helps Wrought Iron Resist Corrosion", by E. P. Best, A. M. Byers Co., *Corrosion*, v. 14, no. 2, Feb. 1958, p. 118. ***F. N. Speller.*** *Corrosion*, v. 14, Nov. 1958, p. 98 + 1 page.

3057* Corrosion Behaviour of Some of the Newer Metals. Corrosion behaviour of Ta, Cb, Ti, Zr, and Be, with particular emphasis on Ti. ***N. P. Inglis and J. B. Cotton.*** *Corrosion Prevention & Control*, v. 5, Nov. 1958, p. 59 + 5 pages.

3058 Lead Alloy Anode for Cathodic Protection. The method of operation of a corrosion product impressed current anode and, in particular, the formation of a conducting oxide film on a lead alloy. ***J. H. Morgan.*** *Corrosion Technology*, v. 5, Nov. 1958, p. 347-352.

3059 Does Higher Fuel Efficiency Increase Corrosion? Discussion of corrosion in high temperature oil burning plants due to inorganic substances, such as V, Na, and S, in residual fuel oils. ***Nigel Seely.*** *Corrosion Technology*, v. 5, Nov. 1958, p. 355-356.

3060 Prevention of Scale and Corrosion With Phosphates and Filming Amines. Hard water scale and corrosion in various types of systems. *Corrosion Technology*, v. 5, Nov. 1958, p. 363 + 2 pages.

3061 The Thermal Oxidation of Cu (111) and (100) Faces. Oxidation was carried out in air in the temperature range 120-350 C. The initial oxide layer formed consisted of cuprous oxide having an amorphous or a fine-grained structure. Increase in film thickness with temperature and/or time of oxidation resulted in the formation of crystalline Cu_2O grown epitaxially with a two-degree $\{111\}$ orientation on both the faces. With further increase in temperature or thickness, mixed two-degree $\{111\} + \{100\}$ orientated Cu_2O was formed presumably as a result of multiple twinning and finally the top layers consisted of randomly disposed or one-degree orientated Cu_2O. ***Y. N. Trehan and A. Goswami.*** *Faraday Society, Transactions*, v. 54, Nov. 1958, p. 1703-1708 + 1 plate.

3062* Cathodic Protection of Mild Steel and Some Copper Alloys Moving in Artificial Sea Water. Corrosion rates increased markedly with movement. Every alloy was protected by supplying cathodic current even under moving conditions. (*In Japanese.*) ***Hayata Shigeno and Toyoji Kobayashi.*** *Government Chemical Industrial Research Institute, Tokyo, Reports*, v. 53, July 1958, p. 250-256.

3063 How to Avoid Piping Corrosion in Nuclear Reactor Plants. Various methods for designing piping for pressurized water reactors. ***W. Z. Friend.*** *Heating, Piping & Air Conditioning*, v. 30, Dec. 1958, p. 105-108.

3064* Corrosion of Copper, Aluminum and Iron in Solutions of Acetic Acid and Ammonium Sulfate. Investigation of the corrosion rates of Cu, Al, Fe, and their alloys in CH_3COOH of comparatively low concentration. Determining effect of phenols on the corrosion in CH_3COOH and investigation of the process in $(NH_4)_2SO_4$ solutions at comparatively high temperatures. (*In Russian.*) Korroziia medi, aliuminiia i zheleza v rastvorakh uksusnoĭ kisloty i sul'fata ammoniia. ***M. V. Konradi.*** *Izvestiia Vysshikh Uchebnykh Zavedenil, TSvetnaia Metallurgiia*, 1958, no. 4, p. 165-171.

3065 Stress-Corrosion Cracking of Austenitic Stainless Steels With Applied E.M.F. Stress-corrosion cracking of chromium-nickel austenitic stainless steels in 42 wt.-% aqueous $MgCl_2$ solution at 150-154 C, saturated with air, was studied under conditions of cathodic or anodic treatment of the metal during the induction period prior to crack initiation and/or during crack propagation. ***J. G. Hines and T. P. Hoar.*** *Journal of Applied Chemistry*, v. 8, pt. 11, Nov. 1958, p. 764-776.

3066* Part Played by Corrosion Inhibitors in the Treatment of Water. Survey of the cold and hot softening and deionizing processes, effects on carbonic anhydride and oxygen. Mechanism and distribution of corrosion. The use of anodic, cathodic, or organic inhibitors, especially sodium benzoate and amines. (*In French.*) Le rôle des inhibiteurs de corrosion dans le traitement de l'eau. ***E. L. Streatfield.*** *Métaux Corrosion-Industries*, v. 33, Oct. 1958, p. 420-430.

3067 Dry Corrosion and Protection of an 80/20 Ni-Cr Refractory Alloy. An investigation to discover the reasons for rupture of blades made from forged heat resistant alloys of

the Ni-Cr 80/20 type. Surface treatment is suggested for protection against crack corrosion. (*In French.*) Corrosion sèche et protection des alliages refractaires Ni-Cr 80/20. ***M. Mathieu.*** *North Atlantic Treaty Organization, AGARD Report No.* 159, Nov. 1957, 21 pp. (TL565 Ag11r Vis.)

3068* Volta Potential on Metal Surfaces During Oxidation and Adsorption. The theory of Volta potential in thin layers. Variations of the potential during oxidation of iron and copper live wires or on small surfaces of copper, iron, nickel, aluminum, and silver during thermal evaporation of oxide. Applying Volta potential to study frictional oxidation in copper and silver. Adsorption and desorption of stearic acid in tungsten. (*In German.*) Die Voltaspannung an Metalloberflächen bei Oxydation und bei Adsorption. ***Werner Schaaffs.*** *Zeitschrift für Angewandte Physik*, v. 10, no. 11, Nov. 1958, p. 503-511.

3069* The Action of Corrosion Inhibitors. The Penetrability of Molecular Layers for Hydrogen Ions. A series of corrosion inhibitors were spread on Fe-surfaces in mono- and polymolecular layers and were tested for their protective effect against attack by acid. Based upon the assumption that the molecular intervals are penetrated by H^+ ions, a lattice-like polysulfide of high protective action against acid corrosion was developed. (*In German.*) Zur Wirkungsweise von Korrosionsinhibitoren. Die Durchlässigkeit von molekularen Schichten für Wasserstoffionen. **Georg Karagounis and Hermann Reis.** *Zeitschrift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie*, v. 62, no. 8, 1958, p. 865-870.

See also: **2771** (Hastelloy lining for vessels); **3007** (pitting of bearings); **3163** (sealing in S.G. iron).

METALS—EXTRACTION AND REFINING

3070* Determination of Active Concentrations of Slag Components Under Consideration of Existence of Ions and Undissociated Compounds. Determination of active concentrations of components in $CaO\text{-}SiO_2$ system. Calculation of dissociation constants of calcium silicates. Determining the amount of free and combined calcium oxide in silicates, and their dependence on slag basicity. (*In Russian.*) Opredelenie aktivnykh kontsentratsii komponentov shlaka pri uchete sushchestvovaniia ionov i nedissotsiirovannykh soedinenii. ***N. M. Chuiko.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Tekhnicheskikh Nauk*, 1958, no. 11, Nov., p. 7-14.

3071* No Moisture—Limestone Used in Furnace. Description of British 20-foot electric arc furnace for alloy and stainless steel. This furnace was lined with limestone instead of burnt lime to avoid, as much as possible, the introduction of moisture into the furnace. *Canadian Metalworking*, v. 21, Dec. 1958, p. 20 + 2 pages.

3072* Ways of Improving Surface of Steel Ingots. Several methods for obtaining high-grade ingots, especially of low- and medium alloy steels are discussed. Determination of tapping temperature and study of; effect of the motion of liquid steel inside the ingot on solidification rate; multi-jet pouring; and formation of gaps between mold and ingot. (*In Russian.*) Puti uluchsheniia poverkhnosti stal'nykh slitkov. ***V. A. Efimov.*** *Izvestiia Vysshikh Uchebnykh Zavedenii, Chernaia Metallurgiia*, 1958, no. 9, Sept., p. 23-28.

3073* Oxidation of Arsenic, Tin, and Antimony in Lead Refining by Molten Alkali. Elaboration of an efficient technology of lead refining and reprocessing of the molten alkali ($NaNO_3$ and NaOH) used. Study of kinetics of the oxidation reaction of As, Sn, and Sb, and of the possibility of a separate oxidation of the impurities. (*In Russian.*) Okislenie mysh'iaka, olova i sur'my pri rafinirovanii svintsa shchelochnymi plavami. ***G. G. Urazov, V. S. Lovchikov, and B. M. Lipshits.*** *Izvestiia Vysshikh Uchebnykh Zavedenii, TSvetnaia Metallurgiia*, 1958, no. 4, p. 96-102.

3074* Experiments on Autoclave Oxidation of Sulfide Goldbearing Concentrates Before Cyaniding. Application of the autoclave method of oxidation as a preliminary operation in cyanidation of sulfide concentrates. In comparison with the usual method of high-temperature oxidizing roasting, the above method permits the achievement of higher gold recovery. (*In Russian.*) Opyt avtoklavnogo okisleniia sul'fidnykh zolotosoderzhashchikh kontsentratov pered tsianirovaniem. ***I. N. Maslenitskii.*** *Izvestiia Vysshikh Uchebnykh Zavedenii, TSvetnaia Metallurgiia*, 1958, no. 4, p. 103-108.

3075* Calculation on Heat Transfer in Reverberatory Furnaces in Copper Melting. Theoretical study. (*In Russian.*) Raschet teploobmena v otrazhatel'nykh pechakh mednoĭ plavki. ***A. M. Davidson.*** *Izvestiia Vysshikh Uchebnykh Zavedenii, TSvetnaia Metallurgiia*, 1958, no. 4, p. 124-135.

3076 Direct Iron Ore Reduction. Technical and economic aspects of various processes. ***P. E. Cavanagh.*** *Journal of Metals*, v. 10, Dec. 1958, p. 804-809.

3077 Copper Refining. Techniques which are of particular interest to non-ferrous founders and ingot manufacturers. *Metal Industry*, v. 93, Nov. 21, 1958, p. 435-436.

3078 The Continuous Casting of Aluminum Alloys. *Norman Goss.* *Precision Metal Molding*, v. 16, Dec. 1958, p. 61 + 5 pages.

3079* Automatic Control of Basic Converter Heats. The melting process in the basic converter. Measuring techniques in obtaining data on the course of blowing. Determining the end of blow. Automation of the control of the process. (*In German.*) Automatische Überwachung der Thomasschmelzen. ***Karl Ernst Mayer, Helmut Knüppel, Arthur Stumpf, and Walter Koch.*** *Stahl und Eisen*, v. 78, no. 23, Nov. 13, 1958, p .1670-1676.

3080* Experimental Melt in a Prehistoric Bloomery Fire. Smelting trial in a bloomery furnace with natural draught, built like a furnace of the Le Tène period. The result of 30 hours of smelting was a slag lump with iron containing 0.09% C present in the form of grains of different sizes. Trials to weld these grains together. Directions for future research. (*In German.*) Versuchsschmelze in einem vorgeschichtlichen Rennofen. ***Josef Wilhelm Gilles.*** *Stahl und Eisen*, v. 78, no. 23, Nov. 13, 1958, p. 1690-1695.

3081* The Final Contents of Bath and Slag in the Basic Converter Process. Dephosphorization factors. Adjustment of the oxygen contents in the steel. Observations on the activity in the system $FeO\text{-}CaO\text{-}P_2O_5$. Influence of the particle size of lime on the reactions occurring between bath and slag. (*In German.*) Die Endgehalte von Bad und Schlacke beim Thomasverfahren. ***Franz Weber and Theo Kootz.*** *Stahl und Eisen*, v. 78, no. 24, Nov. 27, 1958, p. 1734-1745.

3082* Experience in Operation of a Blast Furnace at 1.5 atm. Gauge Top Pressure. (*In Russian.*) Opyt raboty domennykh pechei s davleniem na koloshnike 1.5 atm. ***L. Ia. Levin, I. A. Kuz'min, V. D. Kailov, and A. B. Shur.*** *Stal'*, v. 18, no. 11, Nov. 1958, p. 964-968.

3083* The Experience in Smelting Ferrosilicon From the Krivoy Rog Iron Ores. (*In Russian.*) Opyt vyplavki ferrosilitsiia iz krivorozhskikh rud. ***B. M. Nosovitskii, G. A. Panev, L. V. Brodetskii, and A. G. Kuzub.*** *Stal'*, v. 18, no. 11, Nov. 1958, p. 969-976.

3084* The Expediency of Smelting Ferrosilicon in Blast Furnaces. (*In Russian.*) O tselesoobraznosti vyplavki ferrosilitsiia v domennykh pechakh. ***Iu. S. Maksimov and Ia. S. Shchedrovitskii.*** *Stal'*, v. 18, no. 11, Nov. 1958, p. 976-978.

3085* Production of Various Grade Steels in Basic Converters When Blowing Oxygen From the Top. (*In Russian.*) Proizvodstvo razlichnykh staleĭ v osnovnvkh konverterakh pri produvke kislorodom sverkhu. ***S. I. Lifshits.*** *Stal'*, v. 18, no. 11, Nov. 1958, p. 979-983.

3086* The Use of a Hot-Blast Cupola Furnace at an Integrated Iron and Steel Works. (*In Russian.*) Osnovnaia vagranka s goriachim dut'em na zavode s polnym metallurgicheskim tsiklom. ***S. I. Lebedev.*** *Stal'*, v. 18, no. 11, Nov. 1958, p. 996-997.

3087* Stirring of an Open-Hearth Furnace Bath by Means of Rotating Magnetic Field. (*In Russian.*) Peremeshivanie stali v martenovskikh pechakh pri pomoshchi vrash-

chaiushchegosia magnitnogo polia. ***G. A. Ostroumov.*** *Stal'*, v. 18, no. 11, Nov. 1958, p. 999-1002.

3088* Contributions to the Extraction of Metal by Means of Pressure Reduction. Theoretical considerations on the effect of the pH value and of the CO_2-partial pressure on the pressure reduction with carbon monoxide. Kinetic investigations of pressure reduction with diluted silver salt and copper salt solutions with carbon monoxide. Use of mixed gases of hydrogen and carbon monoxide. (*In German.*) Beiträge zur Metallgewinnung durch Druckreduktion. ***G. Bauch, F. Pawlek, and K. Plieth.*** *Zeitschrift für Erzbergbau und Metallhüttenwesen*, v. 11, Nov. 1958, p. 520-527.

See also: **2545** (Russian steel plant refractories).

METALS—FINISHING, POLISHING, AND CLEANING

3089 Etching and Routing. A comparative analysis is made of the results of producing the same aircraft parts by etching and by routing. *Aircraft Production*, v. 20, Dec. 1958, p. 459-463.

3090 Play It Safe With Degreasing Operations. Points to improve plant safety when using chlorinated hydrocarbons and other solvents. ***Henry Allen.*** *American Machinist*, v. 102, Dec. 1, 1958, p. 108.

3091* Precision Barrelling. The development of new methods and processes by Rolls-Royce Ltd. is described. *Automobile Engineer*, v. 48, Dec. 1958, p. 536-540.

3092* Some Data on Sand Blasting. A study of cleaning with metallic grit and its applications Advantages: absence of harmful dust, better visibility, longer duration, economy. Different qualities of grit, hematite, "super-solid abrasive" grit, cut steel, "veritablacier". (*In Italian.*) Notizie sulla granigliatura. *Fonderia*, v. 7, Oct. 1958, p. 427-433.

3093 New Spray Aids Buffing Quality. A new liquid buffing compound allows an appliance maker to get a quality finish without paying penalty of high costs. *Iron Age*, v. 182, no. 22, Nov. 27, 1958, p. 72-73.

3094 Mechanical Descaling for Wire Drawing. A Survey of the Literature. Discusses the principles of descaling and the problems raised, and describes briefly the descaling machines commercially available. It is concluded that while care is needed in the choice of mechanical descalers for wire required for various uses, there is justification for their wider use in wiredrawing plants. ***G. McH. Sturgeon.*** *Iron & Steel*, v. 31, no. 13, Dec. 1958, p. 563-568.

3095 Polishing and Buffing of Aluminum. ***Lamont J. Benson.*** *Metal Finishing*, v. 56, Dec. 1958, p. 44 + 2 pages.

3096 Effects of Impurities in a Bright Nickel Bath on the Covering Power of a Chromium Bath. ***Robert H. Rousselot and Georges E. Rousselot.*** *Metal Finishing*, v. 56, Dec. 1958, p. 46-50.

3097 Finishing Zinc Base Die Castings. Discussion of protective and decorative coatings in the following categories: electrodeposited metallic and non-metallic coatings, chemical treatments, organic and plastic finishes. ***Lester Spencer.*** *Metal Finishing*, v. 56, Dec. 1958, p. 56 + 4 pages.

3098 Stripping Metallic Coatings. Description and discussion of methods of stripping electrodeposits from various basis metals. ***J. B. Mohler.*** *Metal Finishing*, v. 56, Dec. 1958, p. 60-63.

3099 Finishing Pointers. Discussion of analytical control procedures. *Metal Finishing*, v. 56, Dec. 1958, p. 65.

3100 Plant-Wide Degreaser Solvent System. A new system for receiving, storing, handling, and final disposal of trichlorethylene degreasing solvent is described. *Products Finishing*, v. 23, no. 3, Dec. 1958, p. 52-54.

3101 Pickling of the Zircaloys Prior to Corrosion Exposure. Studies evaluating the feasibility of utilizing common ion neutralizing and H_2SO_4 rinses subsequent to pickling in order to facilitate surface cleaning and minimize acid entrapment. ***S. Kass, D. J. Fontanese, A. E. Oaks, and D. B. Scott.*** *U. S. Atomic Energy Commission, WAPD-TM-141*, Sept. 1958, 61 pp. (UF767 Un3.1wa Contin.)

3102* Investigation of the Industrial Etching of the Surface of Monocrystalline Germanium Before Fusing Indium Into It. Investigation of the industrial etching of Ge after cutting and grinding. Study of the mechanism of etching of Ge in an alkaline etching agent and determination of its optimum composition. Determination of the depth of Ge surface layer distorted during cutting and grinding. Some technological recommendations on etching initial Ge in production of various type instruments, possessing fusion type In-Ge p-n junction. (*In Russian.*) Issledovanie promyshlennogo travleniia poverkhnosti monokristallicheskogo germaniia pered vplavleniem v nego indiia. ***R. E. Smolianskii, V. M. Gurevich, A. M. Raikhlin, and M. I. Lukasevich.*** *Zhurnal Tekhnicheskoi Fiziki*, v. 28, no. 10, Oct. 1958, p. 2135-2141 + 4 plates.

METALS—FOUNDRY PRACTICE

3103 A Method of Casting Radiator-Type Fuel Elements for a Nuclear Reactor. The casting of perforated-hexagon subsections which were 2 and 4 in. high and about 3.9 in. wide containing 397 perforations, 0.165 in. in diameter, was found to be quite practical. Optimum casting conditions for the chromium-uranium eutectic alloy were found to be a pouring temperature of 2000 F with a graphite mold temperature of 1600 F. Although the mold and the core costs for this melting and casting operation are relatively expensive when compared to normal melting practices, the fact that this shape could be cast makes possible the production of such a shape without the addition of excessive machining costs. Casting of larger sections of the perforated hexagon appears to be quite feasible, but the core-alignment problem probably would increase with an increase in the length of casting. ***A. W. Hare and R. F. Dickerson.*** *American Foundrymen's Society, Transactions*, v. 66, 1958, p. 210-212. (TS200 Am35t Vis.)

3104 The Effect of Size of Scrap on the Tapping Temperature of a Cupola. Although most operators of cupola know the general nature of these effects, few know them in sufficient detail to apply numbers to the effects. This paper describes the results of an investigation to determine quantitatively the effects of changes in the size and weight of pieces of cast iron scrap on the tapping temperature and required coke ratio in one particular type of cupola operation. The operation under study was unusual in two ways. First, the charge contained an unusually large percentage of cast scrap. Second, the operation of the cupola is unusually critical because of stringent requirements for close control and excellent uniformity of the iron produced. ***N. H. Keyser and W. L. Kann, Jr.*** Paper from "American Foundrymen's Society, Transactions", v. 66, 1958, p. 397-398. (TS200 Am35t Vis.)

3105* Fluxes and Porous Materials of Gaseous Origin in Molded Aluminium Alloys. Some Practical Results. Having in mind gravity casting in metallic molds, parts that do not lend themselves well to casting because of their design, and definite alloys such as A-S12UN, A-U4NT, A-S10 UG, and A-S20 U, the author studied the conditions obtained in the molten alloy baths in order to produce molded parts free of porosity of gaseous origin. (*In French.*) Les flux et les porosités d'origine gazeuse dans les alliages d'aluminium moulés. Quelques résultats pratiques. ***M. Bernard Chauvelier.*** *Fonderie*, no. 154, Nov. 1958, p. 505-514.

3106 V-4 Motor Block Is Diecast in Aluminum. Operation of the pioneer production line for diecast aluminum V-4 cylinder blocks. Unit is producing 30 castings per hour. ***Jack C. Miske.*** *Foundry*, v. 86, Dec. 1958, p. 62-65.

3107 Feeding Systems for Permanent Mold Castings. Various principles involved in designing of runners, risers, and feeding systems for permanent molds. ***D. Miller.*** *Foundry*, v. 86, Dec. 1958, p. 70-72.

3108 Use of Oxygen in the Coal-Fired Air Furnace. Leads to reduced coal consumption, increased melting rate, better control of the metal bath temperature, reduced oxidation of the readily oxidized elements, and improved slag and metal fluidity. ***J. B. Lapota.*** *Foundry*, v. 86, Dec. 1958, p. 84-85.

3109 Gray Iron Chemistry. How It Affects Casting Quality. Effects of different metal compositions. ***Frank L. Arnold.*** *Foundry*, v. 86, Dec. 1958, p. 86-89.

3110 Ford Opens New Aluminum Diecasting and Permanent Mold Foundry. This modern casting facility converts molten aluminum received from nearby Reynolds reduction plant into 67 different parts for use in engines and transmissions. ***Robert H. Herrmann.*** *Foundry*, v. 87, Jan. 1959, p. 64-69.

3111 What Foundrymen Should Know About Casting Design. Fundamental factors in design which influence the mechanical properties of a casting and bear an important relationship to castability of the part. ***John B. Caine.*** *Foundry*, v. 87, Jan. 1959, p. 74-79.

3112 Close Control Produces High-Property Aluminum Castings. Improvement in strength and ductility is being obtained by improved foundry techniques. The properties of these castings and methods of producing them are described. ***Merton C. Flemings and Howard F. Taylor.*** *Foundry*, v. 87, Jan. 1959, p. 80-81.

3113 Cupola Grit and Dust Arresters. A survey of representative types of cupola grit and spark arresters, both wet and dry, available to the ironfounding industry. ***G. E. Lunt.*** *Foundry Trade Journal*, v. 105, Nov. 27, 1958, p. 651 + 8 pages.

3114* Accelerated Sampling of Molten Cast Iron. Description of a new method. (*In German.*) Beschleunigte Probenahme von flüssigem Gusseisen. ***Wolfram Ruff and Hans-Jürgen Wirth.*** *Giesserei*, v. 45, no. 23, Nov. 6, 1958, p. 700-701.

3115* Replacing the Bottom Parts of Cupolas Without Dismantling the Furnaces. Changing cold blast cupolas into cupolas operated by hot blast—Possibilities for the reconstruction of the melting zone—Supporting the cupola on the charging platform. (*In German.*) Das Auswechseln von Kupolofenunterteilen ohne Abbau der Öfen. ***Gerhard Bienwald.*** *Giesserei*, v. 45, no. 24, Nov. 20, 1958, p. 722-723.

3116 How to Get More for Your Metalworking Dollar. Nonferrous Castings. Up-to-date data on properties and applications of Al casting alloys, Cu based alloys, Mg alloys, Ni based heat and corrosion resistant casting alloys, and Zn diecasting alloys. *Iron Age*, v. 182, no. 24, Dec. 11, 1958, p. 121-136.

3117 Pinhole Porosity in High-Alloy Steel Castings. The important foundry variables influencing pinhole porosity in stainless-type castings are hydrogen content of the melt, pouring temperature, and mold-moisture content. Careful control of these major variables will minimize the occurrence of pinhole porosity in castings under normal conditions. Curves that show the relationship between pouring temperature and hydrogen content of the melt at several selenium and mold-moisture content levels can constitute a useful guide for improving foundry practice. ***R. J. Mangone, A. M. Hall, W. T. Bryan, and C. E. Sims.*** *Journal of Metals*, v. 10, Dec. 1958, p. 810-814.

3118 Bonding Iron to Aluminium by Casting-On. *Light Metals*, v. 21, Nov. 1958, p. 355-356.

3119 Plastics-Bonded Molding Sand for Aluminium and Magnesium Castings. Plastics bonded green-sand molds costing no more than conventional sand molds for producing extremely large and complex aluminium and magnesium castings which are analogous to shell mold castings in surface finish and dimensional accuracy. *Light Metals*, v. 21, Nov. 1958, p. 356-357.

3120* Practical Organization of Statistical Control of Steel Founding. An analysis of the founding defects observed in connection with starting up a new foundry. (*In French.*) Implantation pratique du contrôle statistique en fonderie d'acier. ***Pierre Destable.*** *Métallurgie et la Construction Mécanique*, v. 90, Nov. 1958, p. 849 + 5 pages.

3121* Decisive Factors in the Sensitivity of Alloys to Oxidation. Tests based on Mott's law leading to the measurement of the coefficient of distribution of foreign atoms in a metal. Applications to zinc-based alloys. (*In French.*) La recherche des facteurs déterminant l'aptitude d'oxydation des alliages. ***André Roos.*** *Métallurgie et la Construction Mécanique*, v. 90, Nov. 1958, p. 857 + 2 pages.

3122* Lanthanum, the Rare Earth That Softens Ductile Iron. Minute quantities of La have a potent softening influence on the structure of normally hard ductile iron castings. This softening action extends the range of compositions and section sizes castable with both high strength and good ductility. The addition of a mixture of magnesium ferro-silicon (8.50% Mg-46.00% Si-balance Fe) plus La, or magnesium ferro-silicon plus a special mixture of rare earth metals containing 30% minimum La, added to molten gray iron, will result in a ductile graphite iron. Excess La hardens iron. Only a very minute amount should be used. *Modern Castings*, v. 34, Dec. 1958, p. 24.

3123 Here's How to Cut Rejects and Product Weight. Proposes change to permanent mold castings. ***Robert J. Rutherford.*** *Precision Metal Molding*, v. 16, Dec. 1958, p. 29.

3124 From Ore to Castings—Reynolds-Ford at Muscle Shoals. Describes this Reynolds-Ford producer-consumer complex that Henry Ford predicted 37 years ago. *Precision Metal Molding*, v. 16, Dec. 1958, p. 34 + 4 pages.

3125* Actual State of Melting in Hot-Blast Cupolas. Only two heat recuperators are working in foundries. The industrial results as well as savings obtained with this equipment are described. (*In Czech.*) Současný stav tavení v kuplovnách s předehřatým větrem. ***Břetislav Sochor.*** *Slévárenství*, v. 6, no. 10, Oct. 1958, p. 305-314.

3126* Ceramic Cores. The castings produced with the use of ceramic cores are high-grade and costs in the fettling shop are lower. (*In Czech.*) Keramická jádra. ***Josef Hykel-Jan Čechura.*** *Slévárenství*, v. 6, no. 10, Oct. 1958, p. 314-318.

3127* Production and Foundry Properties Research of Sendust Castings. The fluidity is better than in steel and the tendency to shrinkage is lower than in steel castings. (*In Czech.*) Výzkum výroby a slévárenských vlastností odlitků ze sendustu. ***Zdeněk Hostinský.*** *Slévárenství*, v. 6, no. 10, *Prace Československého Výzkumu Slévárenského*, v. 5, no. 9, Oct. 1958, p. 57-62.

3128* Falcon Airframe Uses Die Casting, Magnesium Structure. A highly efficient design proved possible despite severe space limitations. ***Irwin Stambler.*** *Space/Aeronautics*, v. 30, no. 6, Dec. 1958, p. 18 + 6 pages.

3129* Semicontinuous Casting of Stainless Steel. (*In Russian.*) Polunepreryvnaia razlivka nerzhaveiushcheĭ stali. ***M. S. Boĭchenko, O. T. Gavrilov, Iu. B. Kan, and B. Z. Kononov.*** *Stal'*, v. 18, no. 11, Nov. 1958, p. 983-987.

3130* Measurement of the Open-Hearth Furnace Roof Temperature by Means of the Thermoelectric Pyrometers. (*In Russian.*) Izmerenie temperatury svoda martenovskikh pecheĭ termoelektricheskimi pirometrami. ***I. S. Roginskiĭ.*** *Stal'*, v. 18, no. 11, Nov. 1958, p. 997-998.

3131* Results Obtained in Making Steel With a "D.V.H. Lincar" 5-6 Tons Rotary Furnace Provided With Basic Lining and Oil-Firing. Structural characteristics of the furnace, operating data, consumption fabrication cost for producing 2,000 tons of steel (400 casting operations). Testing the casting process in production by iron ore reduction. (*In Italian.*) Risultati ottenuti nella fabbricazione dell'acciaio al forno rotativo "D.V.H. Lincar" da 5÷6 tonn. a rivestimento basico e con riscaldamento a nafta. ***Agostino Bargone and Emile Alfred Hanne.*** *Tecnica Italiana*, v. 23, no. 7, Nov. 1958, p. 457-465.

See also: **3296** (grain refinement in cast light alloys); **3600** (ventilation of foundries); **3601** (dust and fume control); **3641** (repair-welding of foundry equipment).

METALS—HEAT TREATMENT

3132* Structural Hardening of Aluminum-Nickel Alloys. A study of binary Al-Ni alloys, first tempered, then exposed for a long period of time under isothermal conditions, shows that hardening takes place very slowly. Even small Fe additions have a strong inhibiting effect. (*In French.*) Sur le durcissement structural des alliages aluminium-nickel. ***Henry Martinod and Jean Calvet.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 247, no. 18, Nov. 3, 1958, p. 1462-1464.

3133 Transient and Residual Stresses in Heat-Treated Plates. The temperature is assumed uniform on any plane parallel to the faces of the plate but can vary arbitrarily in the direction normal to the face. The stress distribution during the unloading period is determined exactly without the simplifying assumption of simultaneous unloading. Determination is made of stresses occurring during cooling of a uniformly heated plate. The stress-distribution sequence and residual stresses are calculated for several values of cooling rate and yield stress. ***H. G. Landau and J. H. Weiner.*** *Journal of Applied Mechanics*, v. 25, no. 4, Dec. 1958, p. 459-465.

3134* Experiences in the Operation of Oil-Fired Pusher-Type Furnaces. Transport and storage of the fuel oil. Description and operation of the furnace. Heat consumption. Effect of oil firing on the products heated in relation to their quality. Scaling loss. Experiences with low-pressure air burners. (*In German.*) Betriebserfahrungen mit ölbeheizten Stossöfen. ***Rudolf Müller and Franz Hollweger.*** *Stahl und Eisen*, v. 78, no. 23, Nov. 13, 1958, p. 1676-1678.

3135* Case-Hardening of Free-Machining Steels. Determination made of the surface hardness as well as of the hardness and carbon content within the carburized zone of unalloyed free-machining steels which had been case-hardened to different degrees. The steels contained up to 0.25% S and up to 0.25% Pb approximately. A discussion is presented on the influence of the agent used in annealing for hardening on decarburization of the skin. Conclusions were drawn on the effect of the melting conditions and steels chemical composition on the behavior in carburizing and hardening. (*In German.*) Einsatzhärtung von Automatenstählen. ***Alexander Schepers and Werner Bartholome.*** *Stahl und Eisen*, v. 78, no. 24, Nov. 27, 1958, p. 1745-1748.

3136* Heat Treatment of Cold-Rolled Dynamo Steel in Coils. (*In Russian.*) Termicheskaia obrabotka kholodnokatanoĭ dinamnoĭ stali v rulonakh. ***M. I. Kolov and A. I. Terekhova.*** *Stal'*, v. 18, no. 11, Nov. 1958, p. 1029-1035.

3137* Study of High Speed Tools. XVIII. Water and Air Cooling of High Speed Steels (SKH 8 and SKH 6). Quenched high speed steel that had been cooled in water or air from 800 C (just below the transformation point) could be machined, although it was less softened than steel treated in an annealing furnace. Charts and tables are in English. (*In Japanese.*) ***Hideji Hotta.*** *Tetsu to Hagané (Journal of the Iron and Steel Institute of Japan)*, v. 44, no. 11, Nov. 1958, p. 1284-1287.

3138 Postheat Treating Weldments With an Exothermic Material. Results indicate that 5% Cr-0.5% Mo wrought-pipe weldments can be successfully postheat treated with an exothermic material. ***M. F. Sheely and B. L. Lacey.*** *Welding Journal*, v. 37, Dec. 1958, p. 554s-557s.

See also: **3221** (heat treatment of Armco 17-7 PH stainless steel); **3305** (isochromal annealing of vacancies in Al); **3654** (high frequency induction hardening).

METALS—MECHANICAL AND PHYSICAL PROPERTIES

3139 A High-Temperature, Vacuum, and Controlled-Environment Fatigue Tester. Equipment has been developed for reverse bending fatigue at elevated temperature in vacuum. Large strain amplitudes at low frequencies are used to produce failures in approximately 10^5 cycles. The transmission of motion through a vacuum seal, was solved by the use of a magnetic coupling driven at the resonant frequency of the specimen. Two methods of vibrating the specimen were developed. Provision has been made for automatically stopping the test when a crack has developed through the use of a thyratron circuit. ***G. J. Danek, Jr. and M. R. Achter.*** *ASTM Bulletin*, no. 234, Dec. 1958, p. 48-52.

3140 A Toric Bending Specimen for Investigation of Geometrical Factors in Fatigue. A type of plate bending fatigue specimen having an anticlastic surface in the reduced section is described. The technique appears to be of possible value for certain types of investigation, and possible improvements are discussed. ***J. A. Bennett and Jerome G. Weinberg.*** *ASTM Bulletin*, no. 234, Dec. 1958, p. 53-56.

3141 The Influence of Grain Size on the Stored Energy and Mechanical Properties of Copper. Specimens of commercial Cu (99.98% Cu) of grain sizes 0.150 and 0.030 mm. were used to investigate the variation in mechanical properties and stored energy with deformation. After sufficient strain the mechanical properties become the same for both grain sizes. ***L. M. Clarebrough, M. E. Hargreaves, and M. H. Loretto.*** *Acta Metallurgica*, v. 6, Dec. 1958, p. 723-735.

3142* Experimental Verification of the Laws of Isotropy and Delay in Complex Loading. Experiments with annealed red Cu under complex loading and determination of its vectorial properties by means of laws of isotropy and delay. (*In Russian.*) Eksperimental'naia proverka zakonov izotropii i zapazdyvaniia pri slozhnom nagruzhenii. ***V. S. Lenskii.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Tekhnicheskikh Nauk*, 1958, no. 11, Nov., p. 15-24.

3143* Mechanical Properties of Light Alloys at Low Temperature. From the determination of mechanical characteristics of AP 5 and the Pe 35, Ac 11, Av 24, Eg 55 alloys at temperatures of 0, −25, −70, −115, −138 and −195 C, a sizeable increase of their values has been observed by reducing the temperature of Al 99.5 and Al-Mg type alloys; in the Al-3.5 Mg-H 16 alloy the elongation at −195 C is found to be triple that of room temperature. (*In Italian.*) Caratteristiche meccaniche delle leghe leggere a bassa temperatura. ***L. Mori.*** *Alluminio*, v. 27, no. 11, Nov. 1958, p. 495-501.

3144* High-Temperature Deformation of Steels. A Study of Equicohesion, Activation Energies, and Structural Modifications. High-temperature deformation in tensile, creep, and torsion tests has been carried out on Armco iron and 35/10 Ni-Cr austenite steel. The role played by dislocations during high-temperature intergranular and intragranular modes of deformation is discussed. The results are in agreement with the theories advanced. ***C. Crussard and R. Tamhankar.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 212, no. 6, Dec. 1958, p. 718-730.

3145* Texture of Cold-Rolled and Recrystallized Crystals of Silicon-Iron. Single crystals of Si-Fe were rolled and recrystallized. The texture obtained on recrystallization depends on the orientation of the crystal. Minor components may serve as nuclei for the recrystallizing grains. Rotation relationships are discussed. Polycrystalline textures are rationalized on the basis of components present in the rolled texture. ***J. L. Walter and W. R. Hibbard, Jr.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 212, no. 6, Dec. 1958, p. 731-737.

3146* The Effect of Carbide Dispersion on the Strength of Tempered Martensite. Carbide dispersions in 3 essentially plain carbon martensitic steels (0.42, 0.56, and 0.75 % C) have been studied after varying tempering treatments (800 to 1250 F). Purpose of the study was to verify existing quantitative data on the relationship between carbide spacing and tensile properties and to extend this earlier data to finer structures by the use of electron microscopy. In contrast to the earlier data, a linear relationship between the logarithm of the mean interparticle spacing (mean-free ferrite path) and the yield strength does not hold for the entire range of these

tempered martensite structures. ***A. M. Turkalo and J. R. Low, Jr.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 212, no. 6, Dec. 1958, p. 750-758.

3147* Fracture of Zinc-Monocrystals and Bicrystals. Tests of Zn monocrystals have shown that the fracture stress is reduced by as much as X100 by small amounts of prior plastic glide. Tests of Zn bicrystals have shown that the effect of a grain boundary on fracture depends markedly on the type of boundary. Symmetric boundaries have no effect on either plasticity or fracture. Antisymmetric boundaries raise the plastic resistance but do not reduce the fracture stress. Asymmetric boundaries cause marked embrittlement. ***J. J. Gilman.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 212, no. 6, Dec. 1958, p. 783-791.

3148* Grain Boundary Shear in Aluminum. Observations have been made of the behavior of grain boundaries under a constant shear stress, using controlled orientation tricrystal specimens of Al. Grain boundary shear was observed to take place, without over-all deformation of the component crystals, accompanied by localized deformation and boundary migration. Measurements were made of the boundary shear as a function of time during the tests and the effects of stress, temperature, boundary angle, and added impurities were determined. ***F. Weinberg.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 212, no. 6, Dec. 1958, p. 808-817.

3149* Electrical Properties of Cu-Mn-Al-In-Fe and Cu-Mn-Al-In-Ni-Fe Alloys. Empirical relationships between the composition and some of the electrical properties are established. Equations, based upon the electronic configurations of the alloying elements, describe the resistivity, temperature coefficient, and thermoelectric power of these alloys in the neighborhood of room temperature. ***D. D. Pollock and D. I. Finch.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 212, no. 6, Dec. 1958, p. 841-846.

3150* Substitutional Solid-Solution Strengthening in Copper Alloys. Shear tests were conducted on single crystals of high-purity Cu and of Cu-Mn and Cu-Al alloys. It was concluded that solution strengthening was due to the interaction of solute atoms with the substructure in the metallic lattice. Solution strengthening was found to be structure sensitive and hence it was not possible to find a simple law defining this phenomenon. ***C. D. Wiseman.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 212, no. 6, Dec. 1958, p. 847-852.

3151* On the Problem of Hydrogen Embrittlement of Iron. The ability of hydrogen, charged in Fe, to depress the upper yield point and reduce or eliminate the yield-point elongation has been reconfirmed. It has been shown that hydrogen-charged Fe has strain-aging kinetics which are indistinguishable from uncharged Fe. On the basis of these results, the case is presented that hydrogen displaces carbon and nitrogen from dislocation centers and that hydrogen embrittlement derives from the stabilization of transient and thermally generated crack nuclei formed at lower stress levels. ***A. Siede and W. Rostoker.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 212, no. 6, Dec. 1958, p. 852-855.

3152* Effects of the Structure and Properties of Uranium on Its Behavior Under Irradiation. Growth of textured uranium under radiation. Surface deformation of non-textured uranium. Effects of composition and thermal treatment on structure and mechanical properties. Techniques used in investigating creep in uranium under irradiation. (*In Russian.*) Vliianie struktury i svoistv urana na ego povedenie pod oblucheniem. ***A. S. Zaimovskii, G. Ia. Sergeev, V. V. Tumova, B. M. Levitskii, and Iu. N. Sokurskii.*** *Atomnaia Energiia,* v. 5, no. 4, Oct. 1958, p. 412-420.

3153* Uranium-Molybdenum Alloys in Reactor Construction. (Survey). Mechanical properties of some U-Mo alloys. Effects of room temperature, Mo content, high temperatures, and the type of thermal treatment of different processes (β-treatment, hot rolling, cold pressing). Resistance to radiation, to corrosion in water. Application of these alloys to the fuel elements of nuclear reactors. (*In Russian.*) Uran-Molibdenovye splavy v reaktorostroenii. ***V. V. Kalashnikov, V. V. Timova, G. Ia. Sergeev, and A. G. Samoilov.*** *Atomnaia Energiia,* v. 5, no. 4, Oct. 1958, p. 421-431.

3154* Fatigue Strength of Steel Specimens With Artificial Cracks. Tests carried out to determine the fatigue strength of artificially cracked specimens made from mild steel, 0.45% C steel, 13Cr steel and Ni-Cr steel under rotary bending. Axially cracked specimens gave considerably lower fatigue strength-reduction factors, compared with that of partial circumferentially cracked or round cracked specimens. The shot peening process gave an increased fatigue strength of 18% for mild steel and 30% for Ni-Cr steel specimens with artificial cracks. ***Hisashi Ouchida.*** *Bulletin of JSME,* v. 1, no. 3, Aug. 1958, p. 233-239.

3155 Activation Energy for Creep of Tin. Analysis of the results of constant stress creep tests during steady state creep, and by means of temperature cycling. A value of approximately 9000 cal per g-atom for the creep of high purity SN in the temperature range 300 to 350 K was obtained. ***L. G. Bonar and G. B. Craig.*** *Canadian Journal of Physics,* v. 36, Nov. 1958, p. 1445-1449.

3156* Study of the Mechanical Properties and of Brittle Fracture in Mild Steel. Calculation of the paper elastic limit and of the critical length of the Piobert-Luders bands. Under the conditions of the tests, these bands always formed before brittle fracture which thus takes place probably when the plastic deformation exceeds a critical value. (*In French.*) Étude des propriétés mécaniques et de la rupture fragile de l'acier doux. ***John Barry Lean, Jean Plateau, and Charles Crussard.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences,* v. 247, no. 18, Nov. 3, 1958, p. 1458-1461.

3157 Effect of Surface on the Behaviour of Metals. Contains the four papers presented at the Institution of Metallurgists' annual Refresher Course for 1957, entitled "Methods of Preparation and Examination of Surfaces"; "Influence of Surface Treatments on the Chemical Behaviour of Metals"; Relationship Between Surface Condition, Friction and Wear"; and "Influence of Surface on the Physical Properties of Metals". 100 pp. + 10 plates. 1958. Philosophical Library, New York. (TA407 In7e)

3158 Some Semiconducting Properties of HgTe. The Hall coefficient R and the resistivity p were measured as a function of temperature and magnetic field. ***J. Black, S. M. Ku, and H. T. Minden.*** *Electrochemical Society, Journal,* v. 105, Dec. 1958, p. 723-728.

3159* Research Into Friction. A glimpse of work in progress at the new Ferodo research laboratories in England. Development testing of linings and brakes is performed on inertia testing machines. *Engineer,* v. 206, Nov. 28, 1958, p. 848-852.

3160 A Review of Intergranular Fracture Processes in Creep. Slow deformation of metals at elevated temperatures is known to lead to the development of integranular cracks. Both qualitative and quantitative aspects of the theories relating to such internal fissuring are reviewed, and it is shown that different processes become operative according to the prevailing conditions of stress and temperature. ***P. W. Davies and J. P. Dennison.*** *Institute of Metals, Journal,* v. 87, pt. 4, Dec. 1958, p. 119-125.

3161 The Influence of Annealing Twins on Intergranular Creep Cracking. Experimental evidence is produced which suggests that the crack may be stopped by deformation through the body of the grain along the twin boundary. Where a twin completely crosses a grain and is favorably oriented with respect to the principal stress axis, the shear associated with the crack in the transverse grain boundary may be transferred to the opposite parallel grain boundary, producing there a complementary crack on the opposite side of the twin boundary. ***C. W. Weaver.*** *Institute of Metals, Journal,* v. 87, pt. 4, Dec. 1958, p. 126-127.

3162 How Nickel Affects High-Speed Tool Steels. II. Advantages expected from adding Ni to high-speed steels include improved ductility and resistance to shock. ***R. F. Hehemann and A. R. Troiano.*** *Iron Age,* v. 182, no. 26, Dec. 25, 1958, p. 52-56.

3163 Growth and Scaling in S.G. Iron. The Influence of Silicon. A study has been made of the growth and scaling behavior of nodular graphite irons having from 1.2 to 5.7% Si at temperatures within the range 650 C to 1000 C. Both growth and scaling proceed relatively slowly and are inhibited by increasing Si contents at temperatures below the austenite transformation range. When the critical temperature range is exceeded or nearly exceeded, growth and scaling become excessive and in this field Si seems to promote growth and scaling. A study of the work of others suggests that the growth resistance of a 5.7% Si nodular iron is comparable with that of Silal up to 900 C at least. ***R. J. Maitland and I. C. H. Hughes.*** *Iron & Steel,* v. 31, no. 13, Dec. 1958, p. 573-577.

3164* Effect of Short-Time Heating on Mechanical Properties of Duralumin. Study of the effect of short-time heating (from 10 sec. to 5 min.) on mechanical properties of duralumin D1 in various conditions at room temperature. Also, investigation of mechanical properties of duralumin D1 at various temperatures in a rapid heating and after cooling. Change of mechanical properties during heating occurs very rapidly. (*In Russian.*) Vliianie kratkovremennykh nagrevov na mekhanicheskie svoĭstva duraliumina. ***M. A. Bol'shanina and L. S. Bushnev.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Fizika,* 1958, no. 3, p. 43-47.

3165* Thermodynamic Properties of Melts of the Cu - Ni - S System. Use of the method of electromotive forces in melted electrolytes in order to supplement the existing data on the deviation of Cu-Ni-S melts from the ideal solutions. (*In Russian.*) Termodinamicheskie svoĭstva rasplavov sistemy med'-nikel'- sera. ***I. T. Sryvalin, O. A. Esin, and Iu. P. Nikitin.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, TSvetnaia Metallurgiia,* 1958, no. 4, p. 66-72.

3166* Solubility of Copper, Nickel, Cobalt and Iron Sulfides When Leaching in Ammonia Solutions Under Pressure. Study of the effect of temperature change, leaching time, ammonia concentration, oxygen pressure, concentration of ammonium sulfate, and grinding on the solubility of Cu, Ni, Co, and Fe sulfides (obtained by alloying pure metals with S) in ammonia solutions. (*In Russian.*) Rastvorimost' sul'fidov medi, nikelia, Kobal'ta i zheleza pri vyshchelachivanii v ammiachnykh rastvorakh pod davleniem. ***A. Ia. Naumov and A. A. Tseĭdler.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, TSvetnaia Metallurgiia,* 1958, no. 4, p. 83-90 + 1 plate.

3167 A Theory of Elastic, Plastic, and Creep Deformations of an Initially Isotropic Material Showing Anisotropic Strain-Hardening, Creep Recovery, and Secondary Creep. Stress-strain relations are given for the material, which is macroscopically homogeneous, but inhomogeneous on a microscopic scale. An element of volume is considered to be composed of various portions, which can be represented by subelements showing secondary creep and isotropic work-hardening in plastic deformation. ***J. F. Besseling.*** *Journal of Applied Mechanics,* v. 25, no. 4, Dec. 1958, p. 529-536.

3168 Relief of Thermal Stresses Through Creep. Equations are developed for analyzing the effects of thermal creep on stress distributions. In formulating these elastoplastic equations, the tensile test stress-strain creep data are extended to compound stresses by means of the Mises-Hencky hypothesis. The various equations are manipulated to yield a numerical procedure by means of which the stress and strain components are computed successively at the end of various time intervals. In these calculations it is assumed that the initial creep rates remain constant during each time interval. The resulting equations are applied to the axially symmetric problem of relief of thermal stresses in an infinitely long cylinder which is quickly heated to a parabolic temperature, and maintained at that temperature. ***H. Poritsky and F. A. Fend.*** *Journal of Applied Mechanics,* v. 25, no. 4, Dec. 1958, p. 589-597.

3169* On Indentation of Ball. I. Indentations made on specimens of finite dimensions can be divided into two processes; indentation with the complete restriction and indentation with partial restriction. ***Shigehiko Yazawa, Kiyoshi Sato, Masao Unno, and Go Yaguchi.*** *Journal of Mechanical Laboratory of Japan,* v. 4, no. 1, 1958, p. 1-5.

3170* The Coefficient of Dry Friction of Metals. Determined in air, in vacuum, and in H_2 atmosphere. ***Riitsu Takagi and Yuko Tsuya.*** *Journal of Mechanical Laboratory of Japan,* v. 4, no. 1, 1958, p. 40-41.

3171 Pressure Vessels and the Problem of Brittle Fracture. The mechanism of brittle fracture at low stresses is by no means fully understood, but an enlightened outlook can now be achieved. ***H. Harris.*** *Metallurgia,* v. 58, Nov. 1958, p. 213-217.

3172 Properties of a Large Extrusion Supplied to Specification D.T.D. 363. Test pieces taken from the center of a large heat treated extrusion in an Al-Zn-Mg-Cu type alloy showed a lower tensile strength than those located nearer the surface. ***T. R. G. William, S. W. Hallwood, and R. W. Hayden.*** *Metallurgia,* v. 58, Nov. 1958, p. 219-224.

3173 The Development of Beryllium for Nuclear Reactor Applications. Deals with the production of ingot and powder metal, fabrication, and mechanical properties. ***G. C. Ellis.*** *Metallurgia,* v. 58, Nov. 1958, p. 243-250.

3174* Effect of Internal Flaws on the Fatigue Strength of Aluminum Alloy Rolled Plate and Forgings. Attempts to develop a method for analyzing the fatigue effect of discrete flaws. ***J. L. Waisman, Leo Soffa, P. W. Kloeris, and C. S. Yen.*** *Nondestructive Testing,* v. 16, no. 6, Nov.-Dec. 1958, p. 477-489.

3175 Ductile-Brittle Transition in Steels Irradiated With Neutrons. The yield and fracture stresses of unirradiated and irradiated En2 steel have been measured at 20, −78, and −196 C. The effect of irradiation on the grain size transition from ductile to brittle fracture has been determined experimentally at −196 C. The transition surface relating grain size, yield stress, and temperature has been obtained. ***D. Hull and I. L. Mogford.*** *Philosophical Magazine,* v. 3, ser. 8, Nov. 1958, p. 1213-1222.

3176 Activation Energies for High Temperature Creep of Polycrystalline Zinc. The creep of polycrystalline zinc above 0.5 T_m (T_m = absolute melting temperature) appears to be controlled by two thermally activated processes acting additively. One process, predominating between 0.5 and 0.6 T_m, is believed to be associated with dislocation climb since the experimentally determined activation energy for creep is about equal to the energy for self-diffusion, namely, about 21.0 kcal per mole. The other process, predominating between 0.8 and 1.0 T_m, is believed to be associated with prismatic slip since the activation energies for these two processes are both equal to about 38.0 kcal per mole. ***W. J. M. Tegart and Oleg D. Sherby.*** *Philosophical Magazine,* v. 3, ser. 8, Nov. 1958, p. 1287-1296.

3177 On the Delay Time in Plastic Flow of Indium Antimonide. The delay time before the onset of plastic deformation has been studied as a function of temperature and stress in uniaxial compression. The temperature range was 150-350 C, and the stresses were about 10^6-10^7 dynes/cm^2. ***J. W. Allen.*** *Philosophical Magazine,* v. 3, ser. 8, Nov. 1958, p. 1297-1305.

3178 Thermal Conductivity of Selenium at Low Temperatures. Glassy Se and polycrystalline metallic (hexagonal) Se at temperatures from 2 to above 100 K. ***G. K. White, S. B. Woods, and M. T. Elford.*** *Physical Review,* v. 112, ser. 2, no. 1, Oct. 1, 1958, p. 111-113.

3179 Hall Effect, Magnetoresistance, and Size Effects in Copper. Measurements of the Hall coefficient of several annealed polycrystalline Cu strips revealed the existence of a marked size effect at low temperatures. The effect is considerably greater than that to be expected on the basis of free-electron theory. It is suggested that earlier low-temperature data on the Hall effect of thin high-purity samples are subject to uncertainties arising from such effects. Size effects were also evident in the transverse magnetoresistance. At high fields, a tendency toward saturation in the transverse magneto-resistance was observed for thick samples. The temperature dependence of the Hall coefficient has also been studied. ***Ted G. Berlincourt.*** *Physical Review,* v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 381-387.

3180 Interpretation of the Transverse Magnetoresistance in *p*-Type Indium Antimonide at Liquid Nitrogen Temperature. Results are explained by assuming the presence of heavy holes and less numerous light holes, as in *p*-type Ge. **C. H.**

Champness. *Physical Review Letters*, v. 1, no. 12, Dec. 15, 1958, p. 439-440.

3181 Elastic Scattering of Photons by Tantalum. Describes the results of a measurement of the differential cross section at 120° for the elastic scattering of photons by the Ta nucleus. ***E. G. Fuller and Evans Hayward.*** *Physical Review Letters*, v. 1, no. 12, Dec. 15, 1958, p. 465-467.

3182 Magnetoresistance and Fermi Surface of Alkali Metals. The observed magnetoresistance effects in low fields are used for an approximate estimate of the anisotropy of the Fermi surfaces of alkali metals. The elements appear to be arranged in order of increasing anisotropy as follows: Na, Rb, K, Cs, Li. The Fermi surface in Na is almost spherical. In Li it is considerably anisotropic and it might even contact the Brillouin zone boundary. ***F. García-Moliner.*** *Physical Society, Proceedings*, v. 72, Dec. 1958, p. 996-1000.

3183 The Change of Spontaneous Magnetization With Hydrostatic Pressure. Measurements of the effect of pressure on the spontaneous magnetization of Ni, Co, and a series of Ni alloys were made using a thin-disc permeameter designed to produce high magnetic fields for only a very small power consumption. The results are in good general agreement with the results of other hydrostatic pressure experiments and with the results of experiments on the thermodynamically related 'forced' volume magnetostriction. ***D. Gugan.*** *Physical Society, Proceedings*, v. 72, Dec. 1958, p. 1013-1026.

3184 The Saturation Magnetostriction of Nickel Crystals at Low Temperatures. The saturation magnetostriction λ of two single crystals of Ni has been measured over the temperature range 20 K to 500 K by a capacitance bridge method. ***W. D. Corner and F. Hutchinson.*** *Physical Society, Proceedings*, v. 75, Dec. 1958, p. 1049-1052.

3185 The Spontaneous Magnetization of Nickel + Copper Alloys. Values of $\sigma_{o,T}$ of a Ni + Cu alloy containing 30.75 at.% Cu have been obtained near its Curie temperature. Measurements of spontaneous magnetization and Curie temperature (θ_ℓ) of Ni + Cu alloys containing up to 54.11 at.% Cu using the purely magnetic techniques are described. ***S. A. Ahern, M. J. C. Martin, and W. Sucksmith.*** *Royal Society, Proceedings*, v. 248, ser. A, Nov. 11, 1958, p. 145-152.

3186* Investigation of a Metal Stream by Means of Rapid Filming. (*In Russian.*) Issledovanie strui metalla s pomoshch'iu skorostnoĭ kinos'emki. ***A. G. Il'in and B. Z. Kononov.*** *Stal'*, v. 18, no. 11, Nov. 1958, p. 994-995.

3187* Strength Characteristics of Titanium Alloy With 5% Aluminum Under Conditions of Hot Working. Determination of mechanical properties and degree of permissible deformation for Ti alloy with 5% Al at high temperatures and deformation rates. Determination of the true yield point, velocity coeffiicent, and mean specific pressures originating in rolling with smooth rolls at high temperatures and various degrees of deformation. (*In Russian.*) Prochnostnye kharakteristiki splava titana s 5% aliuminiia v usloviiakh obrabotki davleniem v goriachem sostoianii. ***S. N. Dontsov and S. I. Berman.*** *Tsvetnye Metally*, v. 31, no. 11, Nov. 1958, p. 71-77.

3188 The Diffusion of Xenon in Silver. Temperatures of 500, 600, 700, 735, and 800 C. The activation energy for diffusion is 37.5 kcal per gram atom. ***J. Martin Tobin.*** *U. S. Atomic Energy Commission, HW*-53639, Oct. 1, 1958, 16 pp. (UF767 Un3.1hw Contin.)

3189 High-Temperature Mechanical Properties of Hastelloy B and Hastelloy W. These two alloys were tested to determine their adaptability for use as structural materials in a circulating-fuel reactor. They were found to have excellent corrosion resistance to the fused salts and good high-temperature strength; however, phase transformations occurring within the operating-temperature range of the reactor and causing severe losses of ductility restricts their use. ***C. R. Kennedy and D. A. Douglas.*** *U. S. Atomic Energy Commission, ORNL*-2402, Nov. 28, 1958, 81 pp. (UF767 U3o Contin.)

3190 Deformation Textures in Uranium-Aluminum Alloys. Alloys containing up to 13% U fabricated by extrusion and cold-rolling. Sheet textures of Al, a 5% U-Al alloy, and a 13% U-Al alloy were determined after 90% reduction by cold-rolling. ***William Clarence Thurber.*** *U. S. Atomic Energy Commission, ORNL*-2635, Nov. 20, 1958, 61 pp. (UF767 U3o Contin.)

3191 Analysis of the Creep Behavior of a Square Plate Loaded in Edge Compression. Theoretical analysis; the material is assumed to obey a nonlinear creep law. ***Harvey G. McComb, Jr.*** *U. S. National Advisory Committee for Aeronautics, Technical Note* 4398, Sept. 1958, 42 pp. (TL570 Un3t)

3192* Physico-Chemical Phenomena in Deformation of Metals. A review of basic results of recent investigations in the field of physico-chemical mechanics of metals, with a special attention regard to theoretical interpretation of these results from the viewpoint of dislocation theory. (*In Russian.*) Fiziko-khimicheskie iavleniia pri deformatsii metallov. ***V. I. Likhtman and E. D. Shchukin.*** *Uspekhi Fizicheskikh Nauk*, v. 66, no. 2, Oct. 1958, p. 213-245.

3193 Effects of Preheating, Thermal Stress Relief and Electrode Type on Notch Toughness. Determines what comparative benefits in notch toughness of weldments may be realized through use of preheating for welding, as against thermal stress relief, or by changing from Type E6010 to Type E6016 electrode. ***L. J. McGeady.*** *Welding Journal*, v. 37, Dec. 1958, p. 543s-553s.

3194* Effect of Uniform Compression on the Oscillation of the Magnetic Susceptibility of Bismuth at Low Temperatures. The influence of uniform pressure of about 1000 atmospheres on magnetic susceptibility in a magnetic field up to 13 kOe was investigated at 4.2-1.6 K. (*In Russian.*) Vliianie vsestoronnego szhatiia na ostsilliatsiiu magnitnoĭ vospriimchivosti vismuta pri nizkikh temperaturakh. ***N. B. Brandt and V. A. Ventzel.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 35, no. 5, Nov. 1958, p. 1083-1087.

See also: **3276** (properties of extruded Cr); **3301** (recrystallization of W); **3302** (rolling texture in Cu); **3623** (fatigue strength of welding Mg alloy); **3627** (hot cracking of steel welds); **3628** (effect of H on properties of steel welds); **3635** (wear of pearlitic steel welds); **3780** (deformation of Zn).

METALS—MECHANICAL WORKING

3195 Plain and Fancy Tooling Builds Jupiter Gyros. A curious mixture of tooling at Ford Instrument Company, Long Island City, N. Y., produces delicate gyroscope assemblies that guide Jupiter missiles in flight. ***Joe Holzapfel.*** *American Machinist*, v. 102, Dec. 29, 1958, p. 43-46.

3196 Explosive Forming—Successor to the Heavy Press? *American Machinist*, v. 102, Dec. 29, 1958, p. 47-48.

3197 Helical Broach Cuts Bushing Cost 40%. Inserted teeth, special tool angles, and a simple spiral device made it possible to cut opposed spiral grooves in Oilite aircraft bushings by a broaching tool. ***J. I. McNally.*** *American Machinist*, v. 102, Dec. 29, 1958, p. 53.

3198 Special Stamp Marks Thin-Walled Parts. Precise marking of thin-walled parts during machining is currently in use at the Argus Camera Div. of Sylvania Electric Products, Inc. *American Machinist*, v. 102, Dec. 29, 1958, p. 64.

3199* An Elementary Consideration of Some Extrusion Defects. It is shown that the best upper bounds to the load in direct extrusion when the fault known as piping is anticipated are less than the best upper bounds obtainable by the use of similar deformation patterns when piping is assumed not to be going to occur. ***W. Johnson.*** *Applied Scientific Research, Sec. A, Mechanics, Heat, Chemical Engineering, Mathematical Methods*, v. 8, no. 1, 1958, p. 52-60 + 1 plate.

3200* Rotary Swaging. The operation and its application to stainless steel, Al, Cu, brass, and Ni alloys. ***Lloyd A. Whiting.*** *Automatic Machining*, v. 20, no. 2, Dec. 1958, p. 34-37.

3201* Bodywork Review. An analysis of trends and improvements revealed by a study of the 1959 cars. *Automobile Engineer*, v. 48, Dec. 1958, p. 504-514.

3202 Jones & Laughlin Producing Stainless Steels and Strip at Ohio Plant. The principal equipment of the Louisville, Ohio, Plant includes a 52-inch cluster-type (Sendzimir) cold rolling mill which is capable of rolling stainless steel sheets in thicknesses ranging from 3/16 in. down to .003 in. *Blast Furnace and Steel Plant*, v. 46, Dec. 1958, p. 1295-1296.

3203* "In-Line Production" Feature of New Wolverine Tubing Plant. Horizontal extrusion press is operated by one man standing in main cockpit who also controls the flow of blocks from the saw to the heaters, and from heaters to press. *Canadian Metalworking*, v. 21, Dec. 1958, p. 10 + 4 pages.

3204 How Do Steel Dies Compare With Carbide Dies? A typical carbide die will cost from one and one half to two times that of its tool steel counterpart. All factors being equal, it should produce ten to twelve times as many pieces as that same tool steel die. ***Joseph P. Schmidt.*** *Carbide Engineering*, v. 10, Dec. 1958, p. 9-15.

3205 Programming Flame Cutters Pays Off for Shipyards. Elimination of a shipbuilding bottleneck. ***Derek Barlow.*** *Control Engineering*, v. 6, Jan. 1959, p. 107.

3206 A Survey of Forging Manipulators and Their Applications. Defines the types of forging manipulator available and the use of these machines in relation to the layout of various forging plants. ***P. L. Lillywhite.*** *Iron and Steel Institute, Journal*, v. 190, pt. 4, Dec. 1958, p. 394-413.

3207* Variation in Wall Thickness in Ring Die Drawing of Aluminum Alloy Tubes. Determining the effect of basic parameters of ring die drawing process on the change of wall thickness in drawing Al alloy tubes and establishing technology assuring the minimum increase of tube wall thickness in the drawing process. Investigation of cold-rolled D16 and AMG alloy tubes in as cold rolled and in annealed conditions. (*In Russian.*) Izmenenie tolshchiny stenki pri bezopravochnom volochenii trub iz aliuminievykh splavov. ***M. Z. Ermanok.*** *Izvestiia Vysshikh Uchebnykh Zavedenii, TSvetnaia Metallurgiia*, 1958, no. 4, p. 142-152.

3208* The Influence of Different Factors on Metal Removal and Abrasive Consumption in Grinding Steel With Pendulum Grinding Machines. The influence of different factors on the metal removal and the consumption of abrasives during grinding of rolled steel billets with pendulum grinding machines were determined at several Swedish steel works. Nineteen grinding wheels of different types were tested, and of these five were investigated in detail at grinding pressures of 80, 100, and 120 kg. and at wheel periphery speeds of 35, 40, 45, and 50 m/sec. (*In Swedish.*) Olika faktorers inverkan på avverkning och slipskiveförbrukning vid slipning av stål i pendelslipmaskiner. ***Gunnar Wallquist, Bo Hamrin, and Hans Lund.*** *Jernkontorets Annaler*, v. 142, no. 9, 1958, p. 541-569.

3209* A Photo-Elastic Analysis of Machining Stresses on Rake Face. The stress distributions on the rake face were successfully determined photo-elastically by using a tool made of epoxy resin. The frictional stress on the rake face is uniform over a wide range of the tool-chip contact area regardless of the varying normal stress thereon, but it decreases steeply near the point of chip-separation. ***Eiji Usui and Hidehiko Takeyama.*** *Journal of Mechanical Laboratory of Japan*, v. 4, no. 1, 1958, p. 6-14.

3210* Experiments in the Cold Extrusion of Rods of Non-Circular Section. Experiments in the extrusion of pure Pb and Te-Pb rods of circular, square, rectangular, triangular and I section form. Effects of section shape and punch speed on the necessary extrusion load, and on the nature of the flow of metal within the extruded rod. It is shown that, for a given reduction in area, the load is independent of section shape for all but re-entrant shapes and increases with increase in extrusion speed. ***W. Johnson.*** *Journal of the Mechanics and Physics of Solids*, v. 7, no. 1, Nov. 1958, p. 37-44 + 5 plates.

3211* Understanding Cutting Tool Wear. Wear principles; theoretical considerations; effect of machining parameters on tool life. ***Harry Conn.*** *Machine and Tool Blue Book*, v. 53, Dec. 1958, p. 83-91.

3212 New Techniques for Grinding Sintered Carbides. New method of rough grinding involves raising the temperature of the part to be ground to within 750 to 850 C, and maintaining it at this temperature during grinding. It has been found that at this temperature the sintered carbides are considerably less brittle, and, consequently, less prone to craze cracking. ***E. Zmihorski.*** *Machinery (London)*, v. 93, Nov. 19, 1958, p. 1186-1188.

3213 Machining Operations on Honeycomb Structures. Of nine different types of milling cutters which were specially designed, only two were wholly successful, and both of these were of the knife-edged disc type. ***R. G. Kellner.*** *Machinery (London)*, v. 93, Dec. 3, 1958, p. 1295-1300.

3214 The Production of Ball and Roller Bearings. One of a series of reports on the Hoffmann Manufacturing Co., Ltd., Chelmsford, England. Some of the equipment and techniques used by the company for grading and assembling ball races are discussed. *Machinery (London)*, v. 93, Dec. 10, 1958, p. 1332-1343.

3215 Developments in Gear Cutting and Finishing. Master worm-wheels; requirements for marine propulsion gear hobbing machines; the importance of temperature control when cutting large gears; the need for rigidity in machines for high speed hobbing; creep and non-creep drives; use of combined hobbing and shaving machines for large gears; gear grinding processes; the Maag 0-deg. gear grinding process; arrangements for tooth-form correction on the latest Maag machines. *Machinery (London)*, v. 93, Dec. 10, 1958, p. 1364-1370.

3216 Machining Blades for Gas Turbine Units. Blades are machined from semi-precision forgings, and at an early stage the fir-tree serrations are milled, and then finish-ground on a special Matrix machine, details of which are given. Aerofoil surfaces on certain of these blades are next machined followed by broaching of fir-tree root serrations. *Machinery (London)*, v. 93, Dec. 17, 1958, p. 1392-1404.

3217 Indenting Equipment and Applications. Information is provided on the loads required for indenting various metals with characters of different sizes and with deep and shallow impressions. ***Arnold Throp.*** *Machinery (London)*, v. 93, Dec. 17, 1958, p. 1405-1408.

3218 Erie 2,500-Ton Transfer Forging Press. Claimed to be the first of its type, 2,500-ton transfer forging press is designed for the production of components such as connecting rods, gear blanks, motor-car valves, track links, and wheel hubs, on a fully automatic cycle. *Machinery (London)*, v. 93, Dec. 17, 1958, p. 1410-1411.

3219 High-Output Machining Set-Ups for Cylinder Lock Components. Simple equipment is used for machining operations, but work is expedited by unusual tooling. ***F. J. Giannitti.*** *Machinery (London)*, v. 93, Dec. 17, 1958, p. 1412-1415.

3220 How to Evaluate Formability of Sheet Metal. Bend and draw tests are evaluated. ***D. A. Stewart.*** *Materials in Design Engineering*, v. 48, Dec. 1958, p. 100-102.

3221 Forging and Heat Treating Practices for Armco 17-7 PH Stainless Steel. Design of forging procedures. Solution, aging, and transformation treatment. ***W. J. Davison.*** *Metal Treating*, v. 9, no. 6, Nov.-Dec. 1958, p. 6-8.

3222* Machining With Chemicals. Most important application of chemical machining is the chemical contour etching of Al in the aircraft industry. Other applications are reviewed. ***D. J. Fishlock.*** *Metalworking Production*, v. 102, no. 47, Nov. 21, 1958, p. 2045-2048.

3223* Cutting 200 in. Gears to 0.0002 in. Accuracy. General Electric's set-up is described. ***L. J. Collins.*** *Metalworking Production*, v. 102, no. 47, Nov. 21, 1958, p. 2053-2059.

3224* Air-Chucks Can Solve Workholding Problems. Standard air-chucks, a ready solution to the problem of providing quick-acting effort-free workholding fixtures on rotary indexing tables. ***Metalworking Production,*** v. 102, no. 50, Dec. 12, 1958, p. 2174.

3225* Contour Rolling Complex Shapes. Process for hot forging integral ribs in heavy plates to close tolerances avoids machining in difficult and costly materials used in the aircraft industry. ***F. J. Altmann and R. D. Libert.*** *Metalworking Production*, v. 102, no. 50, Dec. 12, 1958, p. 2184-2186.

3226* Automatic Production of Automotive Gears. Fed with rough turned blanks, line can produce finished, washed, and gauged gears automatically. *Overseas Engineer*, v. 32, Dec. 1958, p. 152.

3227 When Design Calls for an Extruded Aluminum Shape, the Die Is the Key. Details and a checklist for die design. ***Fred G. Schuler.*** *Precision Metal Molding*, v. 16, Dec. 1958, p. 30-31.

3228 Powered Spinning. Important Development in Metal Forming. Built-in "feel" and hydraulic power meet growing needs for larger and heavier parts in shapes most easily made by spinning. *Product Engineering*, v. 30, no. 1, Jan. 5, 1959, p. 42-47.

3229* Sinter Alumina for Cutting Tools. Effect of tool geometry and machining variables on performance. ***Felix Singer and Sonja S. Singer.*** *Refractories Journal*, v. 34, Oct. 1958, p. 456-462.

3230 Designing for Production. II. Deals with the problem of folding and the best use of standard sheet sizes. ***J. V. Harding.*** *Sheet Metal Industries*, v. 35, Dec. 1958, p. 914-916.

3231 Indenting and Embossing. Reviews modern equipment and discusses the relationship of load to depth of impression for different metals, notch effects on indented parts, and refers to die design and manufacturing methods. ***Arnold Throp.*** *Sheet Metal Industries*, v. 35, Dec. 1958, p. 917-922.

3232 Rolling Mill for Nuclear Fuel Elements. A new rolling mill which incorporates remote controlled roll changing and screw down. *Sheet Metal Industries*, v. 35, Dec. 1958, p. 928 + 3 pages.

3233* Recent Investigations on the Relation Between the Formation of the Chip and Tool Life When Turning Steel With Carbide Tips. Relations between characteristic factors governing chip formation: shear stress within the shear zone, chip thickness ratio, main cutting force, velocity of the chip during sliding over the tool face, width of the contact area between chip and tool face and average pressure on the tool face. (*In German.*) Neuere Untersuchungen über den Zusammenhang zwischen der Spanentstehung und dem Standzeitverhalten beim Drehen von Stahl mit Hartmetall-Legierungen. ***Günter Weber.*** *Stahl und Eisen*, v. 78, no. 23, Nov. 13, 1958, p. 1678-1690.

3234* Study of the Effect of the Rolling Conditions on the Properties of Hot-Rolled Low Carbon Steel Strip. II. Mechanical Properties and Structure. Effect of hot and cold working on the mechanical properties and on the structure. Test results and conclusions. (*In German.*) Über den Einfluss der Walzbedingungen auf die Eigenschaften von kohlenstoffarmem Warmband. II. Mechanische Eigenschaften und Gefüge. ***Winfrid Dahl and Werner Lueg.*** *Stahl und Eisen*, v. 78, no. 25, Dec. 11, 1958, p. 1793-1798.

3235* Influence of Carbon Content, Cold Working and Heat-Treatment on the Properties of Deep Drawing Steel Strip Killed by Aluminum. Effect of annealing after cold rolling on the mechanical properties of the strip; effect of the preliminary treatment on the behavior of the strip during temper rolling and its mechanical properties. (*In German.*) Einfluss von Kohlenstoffgehalt, Kalverformung und Wärmebehandlung auf die Eigenschaften von Band aus aluminiumberuhigtem Tiefziehstahl. ***Karlheinz G. Schmitt-Thomas and Heinz Borchers.*** *Stahl und Eisen*, v. 78, no. 25, Dec. 11, 1958, p. 1798-1808.

3236* Study on the Drawing of Titanium Bars as an Example for the Deformability of Materials Difficult to Work. Drawing process and surface finish of the products. Drawing load and calculation of the friction coefficient. (*In German.*) Über das Ziehen von Titanstangen als Beispiel für die Verarbeitbarkeit schwer umformbarer Werkstoffe. ***Werner Lueg and Paul Funke, Jr.*** *Stahl und Eisen*, v. 78, no. 25, Dec. 11, 1958, p. 1816-1822.

3237* The Influence of Re-Drawing and Dressing on the Internal Stresses in Steel Wires. (*In German.*) Der Einfluss des Nachziehens und des Richtens auf die Eigenspannungen in Stahldrähten. ***Hans Bühler and Georg Altmeyer.*** *Stahl und Eisen*, v. 78, no. 25, Dec. 11, 1958, p. 1822-1827.

3238* Conditions for Successful Application of Open-Type Passes When Rolling Angles. (*In Russian.*) Usloviia uspeshnogo primeneniia otkrytykh kalibrov pri prokatke uglovoi stali. ***V. K. Iatsura.*** *Stal'*, v. 18, no. 11, Nov. 1958, p. 1020-1022.

3239* Low-Texture Cold-Rolled Electrotechnical Steel. Methods of manufacturing low-alloy and high-alloy cold-rolled steels. Use of high-temperature annealing. (*In Russian.*) Malotekstsurovannaia kholodnokatanaia elektrotekhnicheskaia stal'. ***A. A. Rastorguev, A. A. Nefedov, P. I. Borzova, A. I. Beliakov, and M. S. Simakova.*** *Stal'*, v. 18, no. 11, Nov. 1958, p. 1023-1029.

3240 You Can Make Ceramic Tools Pay Off. Ceramics work best on long, uninterrupted cuts. The higher the cutting speed, the shorter the tool life. Edge lands reduce the tendency to chip, and they permit higher feed rates. *Steel*, v. 143, Dec. 15, 1958, p. 128-130.

3241 Electrical "Firsts" Update Aluminum Plant. Closed circuit television, electronic and automatic controls help this modern plant to get greater output, higher quality. *Steel*, v. 143, Dec. 29, 1958, p. 60-61.

3242* Increasing of Output of Centerless Grinding Machines by Utilization of Auxiliary Attachments. A description of universal feeders used on centerless grinding machines. (*In Czech.*) Zvýšení výkonu bezhrotých brusek využitím přídavných zařízení. *Strojírenská Výroba*, v. 6, no. 11, Nov. 1958, p. 488-489.

3243* Milling Cutters With Cutting Edges of High-Speed Steel. Design of various cutters for multi-edge tools, and their application in different milling operations. Geometry of milling-cutter edges, and their grinding and fastening. (*In Czech.*) Frézy s břity z rychlořezné oceli. *Strojírenská Výroba*, v. 6, no. 11, Nov. 1958, p. 511-516.

3244* Equipment Requirements for High-Speed Machining. Ceramic tools can cut four times as fast as carbides. In order to utilize this potential productivity, machine tools of new design are required. Characteristics of such machines are outlined. ***H. J. Siekmann.*** *Tool Engineer*, v. 42, no. 1, Jan. 1959, p. 49-52.

3245* Fabricating Stainless Steel. I. Machining. Stainless steel can be readily cut and formed by using modern techniques. Special characteristics of the materials themselves are discussed. ***Richard E. Paret.*** *Tool Engineer*, v. 42, no. 1, Jan. 1959, p. 62-68.

3246* Adjustable-Height Fixture Compensates for Workpiece Irregularities. An adjustable-height stud provides quick, accurate alignment of workpieces. *Tool Engineer*, v. 42, no. 1, Jan. 1959, p. 69.

3247* Westinghouse Mechanizes Low-Volume Production. Full automation is impractical in plants where a variety of products are manufactured in small quantities, but there are many operations where a high degree of mechanization is possible through versatile tooling. ***T. W. Black.*** *Tool Engineer*, v. 42, no. 1, Jan. 1959, p. 81-85.

3248* Diamond Dressing Tools. Describes new standards for shank dimensions of diamond tools used for dressing or truing grinding wheels. *Tool Engineer*, v. 42, no. 1, Jan. 1959, p. 91-92.

3249* Drill It—With a "Cool" Tool. Keeps the drill tip below work-hardening temperatures, making subsequent tapping and reaming less difficult. ***C. Wm. Mossberg and E. J. Weller.*** *Tooling & Production*, v. 24, no. 9, Dec. 1958, p. 44.

3250* Profile-Rolling for Economy, Finish, Strength and Uniformity. Scrap reduction, greater strength, intricacy of shape, lowered fabricating costs, and faster production are also achieved. ***Donald McNary and Kempton A. Whiting.*** *Tooling & Production*, v. 24, no. 9, Dec. 1958, p. 50-52.

3251* Fabrication and Properties of 5005 Aluminum Alloy Cables for Overhead Power Lines. ***Harold W. Adams.*** *Wire and Wire Products*, v. 33, Dec. 1958, p. 1476 + 5 pages.

See also: **3089** (comparison of etching and routing); **3094** (descaling in wire drawing); **3261** (preferred orientation in rolled uranium); **3651** (automatic riveting of aircraft wings); **3653** (pneumatic equipment in forging shops).

METALS—METALLOGRAPHY, TRANSFORMATIONS, AND STRUCTURES

3252 Twins and Phase Transitions in Sodium Tungsten Bronze. The twinned phase is birefringent, and its optical behavior can be described in terms of a tetragonal cell with c/a slightly less than one. ***J. H. Ingold and R. C. DeVries.*** *Acta Metallurgica*, v. 6, Dec. 1958, p. 736-747.

3253 A Transitional h.c.p. Phase in the γ-α Transformation in Certain Fe-Base Alloys. The transitional h.c.p. ϵ phase of martensitic nature in Fe-Mn alloys was shown to form also in ternary Fe-Mn alloys containing Ni, Cr, Co or C. ***B. Cina.*** *Acta Metallurgica*, v. 6, Dec. 1958, p. 748-762.

3254 The Free Energy of Formation and the Interfacial Enthalpy in Pearlite. A constant heat-flow calorimeter was used for the enthalpy of the pearlite-austenite transformation as a function of pearlite spacing in the Fe-C and Cu-Al eutectoids. ***J. J. Kramer, G. M. Pound, and R. F. Mehl.*** *Acta Metallurgica*, v. 6, Dec. 1958, p. 763-771.

3255 On the Nature of the Interface Between a Solid Metal and Its Melt. An anomaly in the reported grain boundary and solid-liquid interfacial energies for Cu and Ag can be explained if it is assumed that the solid-liquid interface is diffuse. ***J. E. Hilliard and J. W. Cahn.*** *Acta Metallurgica*, v. 6, Dec. 1958, p. 772-774.

3256 Electronic Band Structures of the Alkali Metals and of the Noble Metals and Their α-Phase Alloys. In the monovalent metals the structure is strongly affected by the size of the band gap $E_a - E_p$ at the Brillouin zone faces, a large gap implying a large distortion of the Fermi surface. ***M. H. Cohen and V. Heine.*** *Advances in Physics*, v. 7, no. 28, Oct. 1958, p. 395-434.

3257* Eutectoid Transformation of Austenite in Malleable Cast Iron. The diagram of isothermal transformation is plotted for austenite in malleable cast iron. (*In Ukrainian.*) Evtektoidne peretvorennia austenitu v kovkomu chavuni. ***K. P. Bunin, S. L. Voitsel'onok, and S. A. Fedorova.*** *Akademiia Nauk Ukrains'koi RSR, Dopovidi*, 1958, no. 10, p. 1070-1074.

3258* Solubility and Precipitation of Vanadium Nitride in Alpha and Gamma Iron. The solubility of N in Fe and Fe-V alloys containing 0 to 0.5% V is determined by the Sievert's technique for temperatures of 750 to 1200 C. The results for pure Fe agree with earlier data. The activity coefficient of N is decreased by V. The initial precipitate of small metastable particles of VN has a solubility about twice that of the bulk particles. ***R. W. Fountain and John Chipman.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 212, no 6, Dec. 1958, p. 737-748.

3259* Transformation Kinetics of Two Titanium Alloys in the Transition Phase Region. The temperatures and times which govern the existence and nature of the stable and metastable structures for two heat-treatable Ti alloys known to form an ω phase were determined. The alloys, Ti-13Mo and Ti-8Cr, representative of two classes of systems, show different mechanisms of transformation. TTT diagrams of the two alloys are presented. ***S. A. Spachner and W. Rostoker.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 212, no. 6, Dec. 1958, p. 765-769.

3260* Secondary Recrystallization in Silicon Iron. Effects of impurities on the (110) [001] secondary recrystallization texture were studied by making specific impurity additions to high-purity silicon iron. The primary recrystallization texture was found to be very weak, but a (110) [001] component was detected. It was found that the presence of impurities is necessary in order for the strong (110) [001] texture and secondary recrystallization to develop. ***John E. May and David Turnbull.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 212, no. 6, Dec. 1958, p. 769-781.

3261* Preferred Orientation in Rolled Uranium Rods. A study has been made of the preferred orientation in uranium rods rolled to various reductions at 300 and 600 C. The rods used for the 300 C final rolling were obtained from three groups which had been previously either rolled at 600 C, or rolled at 300 C and annealed at 550 C, or β treated. The rods used for the 600 C final rolling were obtained from material previously β treated. It was found that, regardless of the starting material, the orientation obtained was the same if the reduction at 300 C was approximately 70% or greater. ***Melvin H. Mueller, et al.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 212, no. 6, Dec. 1958, p. 793-799.

3262* Determination of the Limiting Segregation of Gallium in Zone-Refined Germanium. Measurements are made of the ultimate distribution of an acceptor impurity element, Ga, in a zone-refined ingot of Ge. The results are in good agreement with the author's theoretical expression for the ultimate distribution, when the value $k = 0.18$ for the distribution coefficient is used. ***L. W. Davies.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 212, no. 6, Dec. 1958, p. 799-801.

3263* The Constitution of Zirconium-Uranium Alloys Containing Oxygen or Nitrogen. The extent of the α-plus-β Zr region in the binary Zr-U system at 660 C has been determined. The phase boundary occurs at 31 wt.% U. This determination is based upon a quantitative study of Zr-U alloys containing O and N; the data were employed in extrapolating to zero O and N content in order to determine the constitution of binary alloys. On the basis of the data obtained, revisions in the constitutional diagrams of the Zr-U and Zr-U-O systems are proposed. A partial Zr-U-N diagram is presented. ***A. A. Bauer, G. H. Beatty, and F. A. Rough.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 212, no. 6, Dec. 1958, p. 801-808.

3264* X-Ray Diffraction Study of the Perfection of Aluminum and Copper Crystals Grown in the Solid State. If proper precautions are taken in handling specimens and in supporting them during annealing, the perfection of Al crystals grown by coarsening (secondary recrystallization) is of a high order. The absence of any low-angle boundaries in crystals grown by either inhibition-dependent or texture-dependent coarsening suggests that the mechanism of nucleation proposed under the name of "geometric coalescense" is not likely to play an important role. The perfection of strain-anneal crystals grown in 2S Al is also very high. ***M. N. Parthasarathi and Paul A. Beck.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 212, no. 6, Dec. 1958, p. 821-827.

3265* X-Ray Analysis of Deformed Germanium, Gallium Antimonide, and Indium Antimonide. Measurements were made of the diffracted X-ray peaks of plastically deformed Ge, GaSb, and InSb. In each case the material was worked at a temperature above its brittle-ductile transition in order to insure plastic deformation. An analysis of the line positions did not indicate the presence of stacking faults in these deformed materials; this is in agreement with considerations of energetics. ***C. Kolm, E. P. Warekois, and S. A. Kulin.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 212, no. 6, Dec. 1958, p. 827-833.

3266* Contribution to the Theory of Inverse Segregation. On the basis of the volume contraction and interdendritic flow mechanism of inverse segregation, the concentration distribution in a unidirectionally cooled ingot of binary eutectic constitution

is calculated. The result shows good quantitative agreement with recent experiments on Al-Cu alloys. ***J. S. Kirkaldy and W. V. Youdelis.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 212, no. 6, Dec. 1958, p. 833-840.

3267* Low-Temperature Resistance Measurements as a Means of Studying Impurity Distributions in Zone-Refined Ingots of Metals. Measurement of electrical resistance at liquid-helium temperatures. Compared with ordinary analytical techniques, the resistivity method is rapid, sensitive, and does not require significant physical disturbance of samples with reasonable shapes. ***J. E. Kunzler and J. H. Wernick.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 212, no. 6, Dec. 1958, p. 856-860.

3268* The Constitution of Delta-Phase Alloys of the System Uranium-Molybdenum-Titanium. The phase relationships occurring between the intermediate σ phases of the U-Mo and U-Ti systems were determined. A ternary cut, based upon studies of alloys ranging in composition from uranium-31.5 at. % Mo to uranium-34 at. % Ti, illustrating these relationships and inferred isothermal ternary sections are presented. ***A. A. Bauer, F. A. Rough, and J. Doig.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 212, no. 6, Dec. 1958, p. 862-868.

3269* Annealing Texture in a Rolled and Artificially Nucleated Aluminum Single Crystal. ***S. Kohara, M. N. Parthasarathi, and P. A. Beck.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 212, no. 6, Dec. 1958, p. 875-881.

3270 Energies of Grain Boundaries in Silver Chloride Crystals. Measurements were made on tricrystals grown by simultaneously drawing three single crystals vertically from a melt. Tricrystals of three different isoaxial orientations, (100), (110), and (111), were studied. Relative grain boundary energies were measured as a function of the orientation differences between two grains forming a boundary in crystals of each of the orientations given above. ***Kathryn A. McCarthy and Bruce Chalmers.*** *Canadian Journal of Physics,* v. 36, Dec. 1958, p. 1645-1651 + 1 plate.

3271* Study of Self-Diffusion of Uranium in the Gamma Phase. Diffusion couples were made of natural U and U enriched in ^{234}U. Coefficients of self-diffusion, the energy of activation, and the frequency factor were determined. (*In French.*) Étude de l'autodiffusion de l'uranium en phase γ. ***Yves Adda and Alexis Kirianenko.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences,* v. 247, no. 9, Sept. 1, 1958, p. 744-746.

3272* Crystal Structure and Chemical Composition of the Dendritic Precipitates Formed in Zinc-Rich Alloyed Brass Types. Two grades of complex brass with a β' matrix were studied by micrography, X-ray diffraction and with a special electrosonic microanalyzer. Solid solution Fe-Mn-Al formed in one, as homogeneous star-shaped precipitates. Ordered Ni-Fe-Al solid solution formed in the other. (*In French.*) Structure cristalline et composition chimique des précipités dendritiques formés dans les laitons alliés riches en zinc. ***Adrienne R. Weill, Jacques Descamps, and Pierre A. Jacquet.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences,* v. 247, no. 20, Nov. 17, 1958, p. 1729-1731.

3273* Electron Microscope Study of Precipitation in the Alloy Al-Zn-Mg Containing 9% Zn and 1% Mg (AZ9G1). The examination by transparency of samples reduced in thickness by ion bombardment shows that between 100 and 150 C the precipitates are small plates oriented on the planes (111). Above 150 C the precipitates are small plates having the same orientation or extended sections in the directions [110]. (*In French.*) Étude au microscope électronique de la précipitation dans l'alliage Al-Zn-Mg à 9% de Zn et 1% de Mg (AZ9G1). ***Bernard Genty, René Graf, and Gabriel Lenoir.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences,* v. 247, no. 20, Nov. 17, 1958, p. 1731-1734.

3274* Study of the Allotropic $\alpha \rightleftharpoons \beta$ Transformation of Zirconium. Relations of crystallographic orientation, effect of the surface relief caused by the shearing mechanism. Diffusion of impurities involved. Iron precipitation during transformation. (*In French.*) Sur l'étude de la transformation allotropique $\alpha \rightleftharpoons \beta$ du zirconium. ***Jean-Paul Langeron and Pierre Lehr.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences,* v. 247, no. 20, Nov. 17, 1958, p. 1734-1737.

3275* Determination of the Relationship Between the Moduli of Shear of Pure Iron and Ferrous Oxide at 20°C. The modulus of shear of ferrous oxide is approximately equal to one half that of pure iron. (*In French.*) Détermination du rapport entre le module de cisaillement d'un fer pur et le module de cisaillement de l'oxyde de fer FeO à 20°C. ***Michel Cagnet, Gaston Collette, and Jean Moreau.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences,* v. 247, no. 22, Dec. 1, 1958, p. 2002-2003.

3276 The Properties of Extruded Chromium. Microstructure and grain boundary behavior of Cr extruded from Cr powder, electrolytic flakes, and arc-melted ingots. ***E. A. Brandes and H. E. N. Stone.*** *Institute of Metals, Journal,* v. 87, pt. 2, Oct. 1958, p. 42-48.

3277 The Constitution of Cadmium-Tin-Zinc Alloys. A study of the alloys by detailed thermal and microscopical analyses. ***H. J. Bray.*** *Institute of Metals, Journal,* v. 87, pt. 2, Oct. 1958, p. 49-54.

3278 The Pseudo-Binary Systems of Uranium Carbide With Zirconium Carbide, Tantalum Carbide, and Niobium Carbide. Three systems were examined. X-ray analysis shows that a complete range of solid solutions exists in each system and that the lattice-spacing/molecular-composition curves obey Vegard's law very closely. ***L. D. Brownlee.*** *Institute of Metals, Journal,* v. 87, pt. 2, Oct. 1958, p. 58-61.

3279 The Molybdenum-Rhenium System. X-ray metallographic, and melting-point studies of the system shows that Re dissolves extensively in Mo. ***A. G. Knapton.*** *Institute of Metals, Journal,* v. 87, pt. 2, Oct. 1958, p. 62-64.

3280 Inhomogeneities of Deformation as They Affect Recrystallization in Zinc. Microscopic observations, using polarized light and with the specimen on a hot stage, allow the direct study of recrystallization in deformed, polycrystalline zinc (99.998%). An attempt is described to relate the strain markings produced by 7.5% compression to the behavior during recrystallization. The general conclusions are that new grains appear and grow rapidly only near grain boundaries and in heavily twinned regions. For all other regions no new grains are observed, and absorption by grains from the regions of rapid growth is slow. Small new grains may be produced by spontaneous recrystallization around indentations made at room temperature, but they do not grow on heating to the annealing temperature because they are deformed owing to differential thermal expansion. Grains stimulated by indentation at the annealing temperature grow only if they are in regions where the naturally occurring grains grow rapidly. ***G. Brinson and M. E. Hargreaves.*** *Institute of Metals, Journal,* v. 87, pt. 4, Dec. 1958, p. 112-119.

3281 A Sensitive Method for Measuring Optical Scattering in Silicon. Instrument is considered as a supplementary tool suitable for studying crystal imperfections in conjunction with other optical methods. ***G. H. Schwuttke, O. A. Weinreich, and P. H. Keck.*** *Electrochemical Society, Journal,* v. 105, Dec. 1958, p. 706-709.

3282 Effects of Certain Chemical Treatments and Ambient Atmospheres on Surface Properties of Silicon. Measurements of surface conductance, recombination velocity, and field effect were made on n- and p-type Si specimens with certain surface treatments and ambient atmospheres. ***T. M. Buck and F. S. McKim.*** *Electrochemical Society, Journal,* v. 105, Dec. 1958, p. 709-714.

3283 Preparation and Some Characteristics of Single-Crystal Indium Phosphide. A technique for purifying phosphorus, reacting elemental indium and phosphorus, purifying the compound, indium phosphide, by a directional recrystallization, and growing large crystals all in one glass tube is described. A crystal puller for decomposable solids is described in detail and results for indium phosphide discussed. The electron

mobility as a function of temperature is given for two single-crystal specimens. An electron mobility of 4000 cm^2/v-sec. at 300 K for a specimen containing a carrier concentration of $1 \times 10^{17}/cm^3$ was achieved. ***T. C. Harman, J. I. Genco, W. P. Allred, and H. L. Goering.*** *Electrochemical Society, Journal*, v. 105, Dec. 1958, p. 731-735.

3284 Properties of Some Germanium Single Crystals Grown From Solutions of Molten Metals. An attempt to obtain single-crystal material, grown under equilibrium conditions at a known, constant temperature, which would be similar to that found in the highly doped side of a p-n junction produced by an alloy fusion technique. ***H. F. John.*** *Electrochemical Society, Journal*, v. 105, Dec. 1958, p. 741-743.

3285* Adsorption of Copper on Quartz. Dilute, aqueous Cu solutions of varying concentration and pH were used. ***P. W. Richardson and H. E. Hawkes.*** *Geochimica et Cosmochimica Acta*, v. 15, nos. 1-2, Nov. 1958, p. 6-9.

3286* Potentiostat in Metallography. Proposes potential values for selective etching of ferrite, sigma-phase, austenite, and austenitic grain boundaries. (*In Czech.*) Potenciostat v metalografii. ***Vladimir Cihal, Milan Pražák, and Miroslav Holinka.*** *Hutnické Listy*, v. 13, no. 6, 1958, p. 496-502.

3287* Electron Microscopic Structural Analysis. Preparation of replicas from steel samples for transmission electron microscopy, including colloid, polystyrene, and carbon extraction types. (*In Czech.*) Elektrónomikroskopická štruktúrna analýza. ***Ivan Hrivňák.*** *Hutnické Listy*, v. 13, no. 6, 1958, p. 526-531.

3288* Semi-Automatic Grinding of Metallographic Specimens of Very Hard Materials. Very hard materials, i.e., B_4C and diamond, were used for polishing the specimens. Boron carbide was dispersed in paraffin on a cast iron disk, and diamond was used as a paste on paper covering the disk of a single-wheel metallographic polishing machine. ***Z. Ministr.*** *Industrial Diamond Review*, v. 18, Sept. 1958, p. 166-170; Oct. 1958, p. 190 + 3 pages. (Translated by ***E. Sudek*** from *Hutnické Listy*, v. 11, no. 3, 1956, p. 154-160.)

3289 A Review of Methods for Assessing Non-Metallic Inclusions in Steel. Microscopic, microradiographic, and magnetic methods are described, together with typical inclusion-count results obtained by some of these methods. Recommendations are made for the use of some of the existing methods on a more scientific basis. ***T. R. Allmand.*** *Iron and Steel Institute, Journal*, v. 190, pt. 4, Dec. 1958, p. 359-372.

3290 Development of Methods for Isolating Structural Constituents in Steels. Lists apparatus, electrolytes used, and sources of error of methods for electrolytic isolation of various structural constituents in steel. ***W. Koch and H. Sundermann.*** *Iron and Steel Institute, Journal*, v. 190, pt. 4, Dec. 1958, p. 373-381.

3291 The Kinetics of Bainite Formation in a Plain Carbon Steel. The rate of isothermal decomposition of austenite was studied in the temperature range 400-100 C for a 0.97% C plain carbon steel. A marked change in the kinetics of decomposition was observed at 350 C. ***P. Vasudevan, L. W. Graham, and H. J. Axon.*** *Iron and Steel Institute, Journal*, v. 190, pt. 4, Dec. 1958, p. 386-391.

3292* Dynamics of Variations in Non-Metallic Inclusions (Oxides) in a Metal During Blowing Process in Bessemer Converter. Studying variations in metal composition, and content and composition of non-metallic inclusions during the blowing process. Separation of non-metallic inclusions from metal by electrolytic method and their complex study by chemical analysis, petrographic investigation, and metallurgical study. (*In Russian.*) Dinamika izmeneniĭ okisnykh nemetallicheskikh vkliucheniĭ v metalle po khodu produvki ego v bessemerovskom konvertere. ***D. I. Turkenich and S. T. Rostovtsev.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Chernaia Metallurgiia*, 1958, no. 9, Sept., p. 37-44.

3293* Effect of Temperature and Pressure on Hydrogen Permeability of Steels and Iron Base Binary Alloys. (*In Russian.*) Vliianie temperatury i davleniia na vodorodopronitsaemost' staleĭ i binarnykh splavov na osnove zheleza. ***R. A. Riabov and P. V. Gel'd.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Chernaia Metallurgiia*, 1958, no. 9, Sept., p. 103-113.

3294* On the Aging of Thin Films of Al-Cu Alloys of Variable Composition. Electron diffraction study of aging of solution heat treated Al-Cu alloys of variable composition in a form of "loose" (without backing), thin (less than 300 Å thick) films obtained by simultaneous evaporation and condensation of components in vacuum. Aging of Al-Cu films approx. 150 to 300 Å thick in a wide range of concentration and temperature (from 20 to 400 C) includes breakdown of solid solution and precipitation of stable θ-phase. (*In Russian.*) O starenii splavov Al-Cu peremennogo sostava v tonkikh plenkakh. ***L. S. Palatnik and B. T. Boĭko.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Fizikà*, 1958, no. 3, p. 112-116 + 2 plates.

3295 Thermal Diffusion of Vacancies in Zinc. Thermal diffusion, or the Ludwig-Soret effect, can be described by adding, to the isothermal flux equation, a second term proportional to the product of the temperature gradient and Q^*, the heat of transport. The magnitude of Q^* for vacancies in zinc was determined by placing markers in a piece of pure zinc, which was then held in a temperature gradient near its melting point. No marker movement was observed in twenty days. Thus the net flux of vacancies was effectively zero so that the effect of the strong concentration gradient was canceled by the thermal-diffusion force. ***Paul Shewmon.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 1032-1036.

3296 Grain Refining Light Alloys. Describes investigations into the effects of the size of the particles of grain refining conditions on the microstructure of the metal and suggests that finer grinding of such additions might have beneficial effects. ***H. Kessler.*** *Metal Industry*, v. 93, Dec. 12, 1958, p. 489-490.

3297 Metallography of Disturbed Uranium Surfaces. ***H. P. Roth and R. B. Russell.*** *Metal Progress*, v. 74, no. 4, Oct. 1958, p. 140-141.

3298 Polishing Hard Metals Electromechanically. Simultaneous use of mechanical and electrolytic polishing avoids layers of worked metal and produces smooth surface in short time. ***J. M. Dickinson.*** *Metal Progress*, v. 74, no. 4, Oct. 1958, p. 142-144.

3299 Polishing by Vibration. Up to 24 specimens can be polished simultaneously without attention of a metallographer. ***E. L. Long and R. J. Gray.*** *Metal Progress*, v. 74, no. 4, Oct. 1958, p. 145-148.

3300* The Aging of Aluminum-Magnesium Cast Alloys. Second part of a study of aging and its relationship to the Mg content and purity. Effect of the room temperature on the properties. Aging at 80 to 175 C during 2 to 64 days, tensile strength and elongation. Brinell hardness of A-alloys without and with deformation after 2 days aging at 125, 150 and 175 C. (*In Dutch.*) Veroudering van aluminium-magnesium-gietlegeringen. ***L. J. G. van Ewijk.*** *Metalen*, v. 13, no. 21, Nov. 15, 1958, p. 376-382.

3301 Recrystallisation of Tungsten Wires. A columnar structure forms first with good retention of strength and ductility. At higher temperatures, secondary recrystallization occurs with embrittlement and lowered strength. ***G. L. Davis.*** *Metallurgia*, v. 58, Nov. 1958, p. 228-232.

3302* On the Origin of the Cube-Texture in Rolled and Recrystallized Copper. A pronounced recrystallization texture can be produced by a transformation of definite crystalline domains present in the deformation texture from which it is formed. (*In French.*) Sur l'origine de la texture cubique dans le cuivre laminé et recristallisé. ***W. G. Burgers.*** *Metallurgia Italiana*, v. 50, Oct. 1958, p. 447-452.

3303* Micrographic Proof Supporting the Dislocation Theory. Review of Taylor's and Burgess' dislocations. Survey of detecting methods used with the electronic or optical microscope. Preparation of thin phthalocyanine crystals of Pt having wide unit cells and exhibiting dislocations in the crystal planes. Different types and propagations. Effect of temperature. Polygonization. (*In French.*) Preuves micrographiques à l'appui de la théorie des dislocations. ***J. B. Lean and J. Plateau.*** *Métaux Corrosion-Industries*, v. 33, Oct. 1958, p. 389-405.

3304 Extra Streaks in the X-Ray Diffraction Pattern of Vanadium Single Crystals. Study of structural implications and their possible interpretation. ***E. Sándor and W. A. Wooster.*** *Nature*, v. 182, Nov. 22, 1958, p. 1435-1436.

3305 Isochronal Annealing of Vacancies in Aluminium. A study based on electrical resistivity measurements at liquid N temperature was carried out on the isochronal annealing out of quenched-in vacancies in 99.995% Al. The process of annealing takes place in two stages; the first stage is centered at about room temperature and takes place at a lower temperature the higher the quenching temperature; also the observed migration energies (in the range 0.37 to 0.58 ev) and the mean number of jumps for annihilation (in the range of 10^4 to 10^6) are very sensitive to the initial concentration of defects, that is, to the quenching temperature. ***C. Panseri and T. Federighi.*** *Philosophical Magazine*, v. 3, ser. 8, Nov. 1958, p. 1223-1240.

3306 Grain Boundary Etching on Pure Aluminium. In the etching of recrystallized Al (both of 99.99% purity, and zone-refined material) in Lacombe and Beaujard's etchant, the grain boundaries are found to resist attack immediately after electropolishing, but to become susceptible to severe attack after periods of a few days at room temperature. It is suggested that this behavior is due to diffusion of impurities along the grain boundaries into the oxide film. ***I. Braun, F. C. Frank, and G. Meyrick.*** *Philosophical Magazine*, v. 3, ser. 8, Nov. 1958, p. 1312-1317.

3307 Thermal Effects of the Martensitic Transformation in Lithium. On cooling below about 80 K the body centered cubic lattice begins to change to hexagonal close packed with stacking faults. ***Douglas L. Martin.*** *Physical Review Letters*, v. 1, no. 12, Dec. 15, 1958, p. 447-448.

3308 The Demagnetizing Energy and Domain Structure of a Uniaxial Single Crystal. The closure domain structure of Co was examined by the Bitter pattern technique on the curved surface of a disc; the results give the conditions under which domains of reverse magnetization are preferred. ***M. Fox and R. S. Tebble.*** *Physical Society, Proceedings*, v. 72, Nov. 1958, p. 765-769.

3309* The Influence of Aluminum Nitride on Size of Grains in Steel. (*In Russian.*) Vliianie nitrida aliuminiia na velichinu zerna v stali. ***Kh. Sh. Levinzon.*** *Stal'*, v. 18, no. 11, Nov. 1958, p. 1036-1037.

3310 The Recrystallization and Grain Growth of Inconel. The effects of cold work, annealing time and initial grain size on the recrystallization temperature of Inconel. Preliminary data on grain-growth characteristics. ***D. A. Douglas and J. R. Weir.*** *U. S. Atomic Energy Commission, ORNL-2406*, Nov. 20, 1958, 29 pp. (UF767 U3o Contin.)

3311* Effect of Degree of Ordering in AB_3 Type Alloy on Its Zone Structure. Calculation of variation in the energy zone of electron conductivity during ordering in an alloy which crystallizes in a face-centered cubic lattice. (*In Russian.*) Zavisimost' zonnoi struktury splava tipa AB_3 ot uporiadochennosti. ***A. I. Gubanov.*** *Zhurnal Tekhnicheskoi Fiziki*, v. 28, no. 10, Oct. 1958, p. 2109-2114.

3312* Theory of Inelastic Scattering of Electrons in Metals. I.-II. Analysis of the problem of inelastic scattering of increased-nonrelativistic-energy electrons in metals provoked by their coulomb interaction with lattice electrons. The solution is made under assumption of successive utilization of the single-electron limit of weak coupling for lattice electrons. Theoretical study. Conclusions of the theory compared with experimental data. (*In Russian.*) Teoriia neuprugogo rasseianiia elektronov v metallakh. I.-II. ***A. Ia. Viatskin.*** *Zhurnal Tekhnicheskoi Fiziki*, v. 28, no. 10, Oct. 1958, p. 2217-2227; no. 11, Nov. 1958, p. 2455-2468.

See also: **3141** (effect of size of grains on properties of Cu); **3145** (crystal orientation of Si-Fe); **3146** (effect of carbide dispersion on strength of materials); **3631** (structure of steel welds).

METALS—POWDER

3313* Some High-Temperature Properties of Nickel-Alloy Powder Extrusions Containing Nonmetallic Dispersions. The experimental powder-metallurgy materials made by extrusion consist of 80/20 Ni/Cr alloy matrices with various hard-phase additions. Stress-rupture tests on the extruded materials carried out at both 1500 and 1800 F showed that the high-temperature strength of the matrix could be increased considerably with certain oxide and carbide additions. High-temperature ductility and room-temperature impact values of some of these materials were low in comparison with cast and wrought alloys. ***Eric Gregory and Claus G. Goetzel.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 212, no. 6, Dec. 1958, p. 868-874.

3314* Production and Properties of Ag-CdO Pseudoalloy. Investigates production of an Ag-CdO pseudoalloy manufactured by internal oxidation at various temperatures and in different environments of a AgCd alloy prepared by a common foundry process. (*In Czech.*) Výroba a vlastnosti pseudoslitiny Ag-CdO. ***Vladimír Volejník and Josef Bican.*** *Hutnické Listy*, v. 13, no. 6, 1958, p. 571-576.

3315 The Effect of Particle Size on the Sintering of Copper Powder. Loose copper powders of spherical form were sintered under vacuum at 650 C for 10 hr. to form a porous material. ***A. Duffield and P. Grootenhuis.*** *Institute of Metals, Journal*, v. 87, pt. 2, Oct. 1958, p. 33-41.

3316 Pressing and Sintering Characteristics of Certain Copper and Tin Powder Mixes. Manufacture of atomized copper powders having apparent densities as low as 2.1 g./ml. and comparison with two electrolytic copper powders when admixed with 10% of tin powder. ***G. R. Bell, F. B. Webb, and R. Woolfall.*** *Metallurgia*, v. 58, Nov. 1958, p. 233-241.

3317 A Review of the Development of Cermets. Cermet materials are defined, and the development of different varieties of cermets are discussed. The physical and mechanical properties of cermets are described, with special reference to the normally poor impact strength and ductility of these materials. Possible ways are considered in which these two properties might be improved. ***G. C. Deutsch, A. J. Meyer, Jr., and G. M. Ault.*** *North Atlantic Treaty Organization, AGARD Report No.* 185, Mar.-Apr. 1958, 20 pp. (TL565 Ag11r Vis.)

3318 Surface Tension of the Binder Metal in Hard Metal Alloys. (*In German.*) Beitrag zur Oberflächenspannung der Bindemetalle von Hartmetallegierungen. ***H. -J. Booss.*** *Planseeberichte für Pulvermetallurgie*, v. 6, no. 1, Apr. 1958, p. 17-21.

3319* Exfoliation of Metals at High Temperatures. Pulverizing experiments carried out at elevated temperatures in an eddy-type mill designed to produce powders by shearing action with a minimum of crushing. ***Kôji Inagaki.*** *Tôhoku University, Science Reports of the Research Institutes, Ser. A. Physics, Chemistry, Metallurgy*, v. 10, no. 5, Oct. 1958, p. 388-399.

See also: **3173** (beryllium); **3664** (bonding cermets of metals).

NONDESTRUCTIVE TESTING AND QUALITY CONTROL

3320 Optical Inspection Checks Out Huge Radar Screens. Tooling points in a 40-ft. assembly fixture had to be established within 0.001 in. ***John Wanner.*** *American Machinist*, v. 102, Dec. 15, 1958, p. 106-107.

3321* Statistical Quality Control in Airline Maintenance. Based on data obtained from a short period of operation, the level of chance variation in the process of producing serviceable airplane flying hours can be calculated and control limits established. Charts can be constructed which clearly show when, where, and for what reason the control limits are exceeded, and investigation and corrective action can be initiated. ***H. G. Packer.*** *Canadian Aeronautical Journal*, v. 4, no. 10, Dec. 1958, p. 347-350.

3322* Dresden Nuclear Container Sphere Leak-Tested Economically. Pressure-differential leak rate method proves vessel's tightness and allows early resumption of in-sphere con-

struction. ***T. H. Smith, J. T. Dunn, and J. E. Love.*** *Electrical World*, v. 150, Dec. 15, 1958, p. 32 + 2 pages.

3323* A Contribution to the International Standardization of Copper Alloys. Definition and casting condition of the so-called "cruciform" test ingot are described. Some disadvantages are mentioned. The principal advantage is to yield 4 tensile test specimens, cast under perfectly symmetrical conditions, out of 3.5 kg of alloy. Effects of impurities are described. Variations of mechanical characteristics for various bronzes are shown. (*In French.*) Contribution a la normalisation internationale des alliages de cuivre. ***Pierre-Julien Le Thomas and Dominique Arnaud.*** *Fonderie*, no. 154, Nov. 1958, p. 515-530.

3324 Steel Quality Control Using the ARL Quantometer. The use of the ARL Production Control Quantometer for the analysis of stainless, low-alloy, and carbon steels is discussed. The results prove that it can be used with a high degree of accuracy for production control analyses. ***H. C. Brown.*** *Journal of Metals*, v. 10, Dec. 1958, p. 815-816.

3325 Magnetic Flaw Detection. Principles on which the technique is based. ***A. G. Gardner.*** *Metallurgia*, v. 58, Nov. 1958, p. 257-259.

3326* Automatic Air Gauge Inspects Roller Races. A completely automatic air gauge for measuring and sorting roller bearing outer races has been produced by Teddington Industrial Equipment Ltd., Sunbury-on-Thames, Middlesex. This gauge is stated to be the first of its kind installed in this country. *Metalworking Production*, v. 102, no. 47, Nov. 21, 1958, p. 2043-2044.

3327* Optical Tool Inspects Long Bores. Checks every square inch of the inside of a tube that is 25 ft. long and only 5¾ in. in diameter. ***Robert Weglin and Fred R. Miller.*** *Metalworking Production*, v. 102, no. 48, Nov. 28, 1958, p. 2090.

3328* Thallium^{204} X-Radiography. The Tl-204 X-radiation source can be used for technical radiography of fairly "thin" objects, giving rather good definition and contrast. ***J. G. Kereiakes and G. R. Kraft.*** *Nondestructive Testing*, v. 16, no. 6, Nov.-Dec. 1958, p. 490-492.

3329* Industrial Applications of Radioisotopes, Nuclear Liquid Level Gauges. Reviews radioisotope capabilities. ***Stelios Regas.*** *Nondestructive Testing*, v. 16, no. 6, Nov.-Dec. 1958, p. 493-494.

3330* Electromagnetic Testing of Tubing: Standardization of Specifications and Test Methods. I. *Richard Hochschild.* *Nondestructive Testing*, v. 16, no. 6, Nov.-Dec. 1958, p. 495-499.

3331 Inexpensive Apparatus for Interferometrically Measuring Thickness of Electroplated Chromium and Other Thin Films. Necessary optical equipment are a microscope equipped with vertical illumination, a monochromatic light source, and a piece of sufficiently flat, transparent glass laid on the specimen. Thickness measurements are possible to at least 100 microinches (0.0001 in.) with accuracy around two microinches (0.000002 in.). ***Roger L. Saur.*** *Plating*, v. 45, Dec. 1958, p. 1232-1233.

3332 Use of Radioisotopes in Filler Metal for Nondestructive Inspection. Use of slightly radioactive welding wire as a means of nondestructive examination of uniformity and penetration in a weld with a radioactivity monitoring instrument. ***Paul T. Barnes and Gordon L. Locher.*** *Welding Journal*, v. 37, Dec. 1958, p. 1176-1181.

See also: **3634** (inspection of welds).

NUCLEAR PHYSICS, NUCLEONICS, AND RADIATION

3333* A Contribution to the Néel Chain Theory. Calculation of the magnetic moment of a linear atomic chain in the case of a positive exchange integral. The deorientation effect of an outer magnetic field placed in an antiparallel direction to the spin position of the ground state is accompanied by an increasing number of the nearest neighbors such as $f^{-3}/^{2}$ after zero. (*In German.*) Zur Theorie der Néelschen Kette. ***E. Ledinegg and P. Urban.*** *Acta Physica Austriaca*, v. 12, no. 2, Oct. 1958, p. 144-154.

3334* The Dimensioning of Shielding Walls Against Gamma Radiation. The graphical method recommended makes it possible to determine the thickness of the lead walls even where several isotopes of differing activities are simultaneously employed. ***L. Tihanyi.*** *Acta Technica Academiae Scientiarum Hungaricae*, v. 21, nos. 3-4, 1958, p. 255-274.

3335 Minimizing Off-Flavors of Irradiated Foods. Problems of unpleasant tastes and odors in the treated foods must be solved before mass preservation of perishable food is acceptable. ***Aaron L. Brody.*** *Agricultural Engineering*, v. 39, Dec. 1958, p. 760-762.

3336* Proton-Proton Scattering at Energies From 46 to 147 Mev. Measurements of the polarization at 45°, taken at 10-Mev intervals between 46 and 147 Mev, yield results about 20% higher than predicted by Gammel and Thaler. ***J. N. Palmieri, A. M. Cormack, N. F. Ramsey, and Richard Wilson.*** *Annals of Physics*, v. 5, Dec. 1958, p. 299-341.

3337* Unified Theory of Nuclear Reactions. A new formulation of the theory of nuclear reactions based on the properties of a generalized "optical" potential is presented. The real and imaginary part of this potential satisfy a dispersion type relation while its poles give rise to resonances in nuclear reactions. ***Herman Feshbach.*** *Annals of Physics*, v. 5, Dec. 1958, p. 357-390.

3338 Annual Review of Nuclear Science. Contains 13 papers covering invariance, the optical model, hyperfragments, antinucleons, γ-ray spectroscopy, advances in accelerators, cosmic radiation, residual radiation, geochronology, hazards, radiobiology, and other subjects. ***Emilio Segrè, Gerhart Friedlander, and Walter E. Meyerhof, editors.*** v. VIII. 417 pp. 1958. Annual Reviews, Inc., Palo Alto, California. (QC780 An78 Vis.)

3339* Decay Modes and Lifetime of Negative Heavy Mesons. Twenty-one events representing possible decays of a negative K-meson in emulsion have been measured in order to get the relative abundances of different decay modes, an estimate of the contamination from nuclear reactions, and a determination of the mean lifetime. ***S. Nilsson and A. Frisk.*** *Arkiv för Fysik*, v. 14, no. 4, 1958, p. 293-302.

3340* Emission of Charged $\Sigma + \pi$ From K^--Proton Capture in Nuclear Emulsions. ***S. Nilsson and A. Frisk.*** *Arkiv för Fysik*, v. 14, no. 4, 1958, p. 303-314.

3341* The Magnetic Dipole Transitions in Xe^{129m} and Cs^{133}. The half-life of the 1-forbidden magnetic dipole transition in Xe^{129m} has been measured by the method of delayed coincidences and by using a multichannel time analyzer. ***T. Alväger, B. Johansson, and W. Zuk.*** *Arkiv för Fysik*, v. 14, no. 4, 1958, p. 373-382.

3342* Physical and Engineering Problems Concerning the Construction of Small Size Shields. Designing small shields of nuclear reactors suitable for transportable plants and problems involved such as radiation of reactor, transmission of gamma-rays and neutron through the shield layer, capture of gamma rays; mounting the shields, choice of materials, best disposition of layers inside the shield. (*In Russian.*) Fizicheskie i inzhenernye problemy konstruirovaniia malogabaritnykh zashchit. ***V. I. Kukhtevich and S. G. Tsypin.*** *Atomnaia Energiia*, v. 5, no. 4, Oct. 1958, p. 393-402.

3343* Complex Automation of Nuclear Reactor Operation. A study of measuring and signaling systems with tract detector and direct amplification of a differential signal integral. Automatic control of the reactor power by means of the mobile detector. Two variants of such type of complex automation and comparison. (*In Russian.*) Kompleksnaia avtomatizatsiia upravleniia iadernymi reaktorami. ***P. Kovanits and M. Kulka.*** *Atomnaia Energiia*, v. 5, no. 4, Oct. 1958, p. 403-411.

3344 Soviets Flight Testing Nuclear Bomber. *Aviation Week* artist's conception of how Soviet nuclear-powered bomber prototype looks in three-view. Nuclear powerplant air intakes are approximately 6-ft. in diameter. Radiation shielding details are not available, but divided shielding concept is used with

heavy shielding around nuclear powerplants and additional shielding protecting crew compartments. Atomic powerplants producing 70,000 lb. thrust are combined with turbojets for initial operations. *Aviation Week*, v. 69, Dec. 1, 1958, p. 27-29.

3345 γ-Ray Yield and Spectra Produced by Irradiating Backing Materials With Protons. Thick targets of Cu, Ag, Au, W, Mo, Ti, Ta, and Sn were irradiated by protons in the energy range 0·6 to 2·8 MeV and the total γ-ray yield measured as a function of proton energy. ***S. E. Hunt, R. A. Pope, W. W. Evans, and D. A. Hancock.*** *British Journal of Applied Physics*, v. 9, Nov. 1958, p. 443-446.

3346 The Electron Neutrino Angular Correlation in the Beta Decay of the Free Neutron. The electron neutrino angular correlation coefficient has been measured for the beta decay of the free neutron by measuring the momentum spectrum of the electrons emitted in a restricted angular range from the direction of the recoil protons. ***J. M. Robson.*** *Canadian Journal of Physics*, v. 36, Nov. 1958, p. 1450-1475.

3347 Successive Decays From Pr^{137} and Ce^{137m}: Decay of Adjacent Praseodymium Isotopes. The decay of Pr^{137} entirely to a 9.0-hour ground state of Ce^{137} was independently discovered. ***G. T. Danby, J. S. Foster, and A. L. Thompson.*** *Canadian Journal of Physics*, v. 36, Nov. 1958, p. 1487-1508.

3348 The Quenching of Triplet Positronium by Ions in Aqueous Solutions. Measurements of positron lifetimes in aqueous solutions have been performed using a fast time-to-amplitude converter with a resolving time of about 10^{-9} sec. The lifetime, τ_2, of the long-lived component of the complex decay observed in water has been found to decrease when paramagnetic salts are added. The experimental results are interpreted in terms of "pickoff" annihilation to explain the observed τ_2 in pure water, and a rapid triplet ↔ singlet conversion process to account for the quenching of the τ_2 component. ***R. E. Green and R. E. Bell.*** *Canadian Journal of Physics*, v. 36, Dec. 1958, p. 1684-1695.

3349* A Maser Device With a Nuclear Magnetic Resonance in Weak Fields. Description of a new device developed by the authors. (*In French.*) Un maser à résonance magnétique nucléaire dans les champs faibles. ***Henri Benoit, Pierre Grivet, and Henri Ottavi.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 247, no. 22, Dec. 1, 1958, p. 1985-1988.

3350 NMR for Control Analyses. Moisture analysis by NMR may solve a difficult control problem. ***R. F. Wall.*** *Industrial and Engineering Chemistry*, v. 50, Dec. 1958, p. 69A-70A.

3351* Advanced Reactors. II. Later Solid-Fuel Types. Two important reactors have a solid fuel—the fast reactor and a high-temperature gas-cooled thermal reactor. ***J. V. Dunworth.*** *Institution of Electrical Engineers, Journal*, v. 4, no. 47, Nov. 1958, p. 590-596.

3352* The Inner Conversion Lines of the γA, γE, γDh Radiation of the Active Thoron Deposit. Comparison of the low-energy electron spectra of Th (B+C+C′+C″) and Th (C+C′+C″) obtained in a magnetic spectrograph at 180 C. (*In French.*) Les raies de conversion interne des rayonnements γA, γE, γDh du dépôt actif du thoron. ***José Sant'ana Dionisio.*** *Journal des Recherches du Centre National de la Recherche Scientifique*, no. 42, Mar. 1958, p. 61-77.

3353 On the Efficiency of a Concentric Cut-Off Rod of a Thermal Reactor as a Function of the Inserted Length of the Rod. Determining the efficiency of a partially inserted control rod of a thermal reactor by calculating the buckling. ***G. M. Schindler.*** *Journal of Nuclear Energy*, v. 8, nos. 1-3, pt. 1, Nov. 1958, p. 18-32.

3354 The Diffusion Cooling of Neutrons in a Finite Moderator. The phenomenon of "diffusion cooling" is investigated within the context of energy-dependent diffusion theory. ***Mark Nelkin.*** *Journal of Nuclear Energy*, v. 8, nos. 1-3, pt. 1, Nov. 1958, p. 48-58.

3355 ^{235}U Fission Product Yields in the Rare Earth Region. The yields of ^{139}La, ^{143}Pr, ^{147}Pm and ^{149}Pm were measured for the first time. ***V. K. Gorshkov, R. N. Ivanov, G. M. Kukabadze, and I. A. Reformatsky.*** *Journal of Nuclear Energy*, v. 8, nos. 1-3, pt. 2, Nov. 1958, p. 69-73.

3356* Long Range Spin-Spin Interactions in High Resolution Nuclear Magnetic Resonance and the Concept of Hyperconjugation. An attempt is made to account in a qualitative way for the observed spin-spin couplings by ascribing them largely to hyperconjugation between methyl group orbitals and π-electron orbitals. The connection of these observations with electron spin resonance spectra is mentioned. ***R. A. Hoffman.*** *Molecular Physics*, v. 1, no. 4, Oct. 1958, p. 326-330.

3357* List of Particle Accelerator Installations. Accelerator installations throughout the world are listed here with the types of particles accelerated and the energy and other characteristics of the machines. Geographical distribution of these accelerators by type of accelerator and country is tabulated, as is the distribution of the machines in the United States according to type of machine and primary activity of the organization. ***Gerald A. Behman.*** *Nuclear Instruments*, v. 3, no. 4, Oct. 1958, p. 181-200.

3358* Measurement and Automatic Control of the Energy of a 31 MeV Betatron. A simple method to control the energy of a betatron is proposed. It compares a signal proportional to the average e.m.f. during the acceleration period derived from a measuring loop to a suitable reference voltage, and derives an error signal which operates small changes in the expansion time. ***U. Farinelli, F. Ferrero, and R. Malvano.*** *Nuclear Instruments*, v. 3, no. 4, Oct. 1958, p. 218-222.

3359* Choice of Collimators for a Crystal Spectrometer for Neutron Diffraction. Establish some criteria for the choice of the collimators for a crystal spectrometer for neutron diffraction in order to achieve a good compromise between luminosity and resolution. General expressions for the full width at half maximum and for the luminosity of the diffraction peaks are developed for powder sample. The advantage of the parallel arrangement is also computed. ***G. Caglioti, A. Paoletti, and F. P. Ricci.*** *Nuclear Instruments*, v. 3, no. 4, Oct. 1958, p. 223-228.

3360* Internally Reflecting Čerenkov Counter for High Energy Protons. A high energy proton detector is described, which utilizes multiple internal reflections of Čerenkov radiation to achieve a sharp energy threshold. The detector is capable of accepting a charged particle beam of cross section comparable to that of the radiator. A preliminary version of the counter has been studied experimentally in the 500-900 MeV proton energy range. The performance of the detector agrees with that expected, when allowance is made for various factors which limit the resolution. ***N. E. Booth, F. L. Hereford, and G. W. Hutchinson.*** *Nuclear Instruments*, v. 3, no. 4, Oct. 1958, p. 229-232.

3361* New Type of Angular-Distribution Chamber. A chamber to be used in the observation of charged particles from nuclear reactions is described. This chamber allows observations to be taken over the continuous range −25° to + 145° with respect to the incident beam without opening the vacuum system. ***R. L. Clarke.*** *Nuclear Instruments*, v. 3, no. 4, Oct. 1958, p. 233-236.

3362* Studies of Neutron Production in Linear Deuterium Pinches. The stabilizing effect of an external magnetic field has been investigated. This effect has appeared in two ways. Firstly, peaks in the voltage curves and dips in the current curves, which are interpreted as due to sausage instabilities, disappear at $B_z > 400$ gauss. Secondly, the number of subsequent pinches is increased by the field and as many as six consecutive pinches have been observed. The dependence of the neutron yield on the magnetic field has been found to be very weak, the yield decreasing only by a factor of ⅔ for 760 gauss. ***P. Ohlin, K. Siegbahn, T. Sundström, and S. Svennerstedt.*** *Nuclear Instruments*, v. 3, no. 4, Oct. 1958, p. 237- 244.

3363* Spinning Properties of the Atomic Nucleus. The motion of nucleons in a non-spherical potential is considered. Without changing the dynamical variables of the nucleons, the Hamiltonian and the magnetic moment operator are put into such a form as to contain collective rotations about axes perpendicular to a body-fixed axis. (*In German.*) Über

die Kreiseleigenschaften des Atomkerns. ***Lothar Meichsner.*** *Nuclear Physics*, v. 8, no. 5, Nov. 1958, p. 493-594.

3364* **Repulsive Core Forces in the Triton.** The present paper deals with the discussion of the effect of 'repulsive core' forces within the main, attractive, interaction. ***J. M. Blatt and G. Derrick.*** *Nuclear Physics*, v. 8, no. 5, Nov. 1958, p. 602-606.

3365 Nuclear Reactors for Power Generation. Intended primarily for that increasingly large group of engineers who will be closely associated with the building and operation of nuclear power stations without necessarily being responsible for their actual design. ***E. Openshaw Taylor, editor.*** 144 pp. 1958. Philosophical Library, New York. (TK9145 T21.4n)

3366* **Fission Power Distribution Near a Cruciform Water Gap.** An experiment was conducted in a critical assembly to determine water channel power peaking in a heterogeneous, highly enriched, water-moderated reactor subassembly. Data were obtained on the interacting effects of the control rod channel and bottom reflector power peaks. ***E. R. Sanford and H. J. Litke.*** *Nuclear Science and Engineering*, v. 4, Dec. 1958, p. 713-726.

3367* **Plutonium Fast Power Breeder With Oxide Fuel and Blanket Elements.** An illustrative design is presented which has five atoms of uranium per atom of plutonium in the core and 45% sodium, a breeding ratio of 1.4 and a critical mass of 400 kg. ***John B. Sampson and E. A. Luebke.*** *Nuclear Science and Engineering*, v. 4, Dec. 1958, p. 745-761.

3368 Planning—and Operating a Critical Facility. Covers site selection, critical-facility building design, equipment, and proposed staff in planning phase, and fuel design, hazards evaluation, assembly preparation, and operating rules in the operating phase. ***F. J. Jankowski and J. W. Chastain.*** *Nucleonics*, v. 16, Dec. 1958, p. 48-50.

3369 The APPR Zero-Power Experiments. Six searching questions and their answers are given. ***John W. Noaks.*** *Nucleonics*, v. 16, Dec. 1958, p. 51 + 1 page.

3370 Measuring γ-Ray Spectra With Large Plastic Scintillators. ***G. L. Brownell, W. H. Ellett, and H. D. LeVine.*** *Nucleonics*, v. 16, Dec. 1958, p. 68 + 1 page.

3371* **Capture of μ-Mesons in Deuterium.** The neutron spectrum, the neutron asymmetry with respect to muon spin direction, and the neutron polarization are calculated as functions of neutron energy for μ-meson capture. ***H. Überall and L. Wolfenstein.*** *Nuovo Cimento*, v. 10, ser. 10, no. 1, Oct. 1, 1958, p. 136-149.

3372* **High-Energy Electron Scattering From Nuclei With Finite Charge Distributions.** By applying a relativistic extension of Molière's formula for the electron scattered amplitude to the particular case of potentials generated by radial charge distributions of finite extent, it is shown that the amplitude can be resolved into three distinct contributions: (1) the Mott point-charge scattered amplitude; (2) a correction to this arising from the finite radial cut-off and (3) a term characteristic of the charge distribution. ***H. S. Valk.*** *Nuovo Cimento*, v. 10, ser. 10, no. 2, Oct. 16, 1958, p. 200-204.

3373* **A Note on the Apparent Inconsistency Among Measurements of Threshold Pion Interactions.** The apparent inconsistency among threshold pion interactions is resolved by the use of extrapolation procedures for charge exchange and photoproduction amplitudes more in accord with theory than conventional linear extrapolations. ***M. Cini, R. Gatto, E. L. Goldwasser, and M. Ruderman.*** *Nuovo Cimento*, v. 10, ser. 10, no. 2, Oct. 16, 1958, p. 243-258.

3374* **On the Momentum Dependence of the Nuclear Potential.** It is shown that the potential energy of a nucleon in the nucleus, evaluated in the first approximation of the perturbation method or on the basis of Brueckner's theory, obeys a hyperbolic partial differential equation, which is independent of any nuclear parameter and is established by the antisymmetry properties of the nucleon assembly only. ***C. Villi.*** *Nuovo Cimento*, v. 10, ser. 10, no. 2, Oct. 16, 1958, p. 259-291.

3375* **On Corollaries From the Two-Component Nature of the Electron in β-Interactions.** A necessary and sufficient condition for the value v/c of the longitudinal polarization of the electron is discussed. ***B. L. Ioffe and V. A. Ljubimov.*** *Nuovo Cimento*, v. 10, ser. 10, no. 2, Oct. 16, 1958, p. 355-358.

3376* **Polarization of Electrons of Integral Conversion Following the β-Decay Taking Into Account the Electric Field of the Nucleus.** The correlation of the polarization of conversion electrons with the direction of emission electrons of the preceding β-decay has been considered. In the entire computation the electric field of the nucleus has been taken into account. Computation of the electric field of the nucleus results in the appearance in magnetic transitions of a considerable transversal component of polarization, while in the electrical transitions the magnitude of polarization is increased substantially. ***B. V. Geškenbein.*** *Nuovo Cimento*, v. 10, ser. 10, no. 2, Oct. 16, 1958, p. 365-374.

3377 Observations of K^--Meson Interactions in Nuclear Emulsion. A total of 23.6 meters of K^--meson track in nuclear emulsion have yielded unbiased samples of 815 absorptions at rest and 106 in flight. The corresponding interaction mean free path is $21.5\ ^{+2.8}_{-1.9}$ cm. for K^--mesons of energy below 90 MeV. Observations are reported on the disintegration stars themselves and on the charged hyperons produced. ***G. B. Chadwick, et al.*** *Philosophical Magazine*, v. 3, ser. 8, Nov. 1958, p. 1193-1212.

3378 The Scattering of Long Wavelength Neutrons by Irradiated and Unirradiated Quartz. Measurements have been made of the transmission of neutrons of wavelengths between 5 and 10 Å through 10 cm. of unirradiated and pile irradiated Brazilian quartz crystals. The measurements are discussed in relation to optical absorption measurements and radiation damage theory. ***E. W. J. Mitchell and P. T. Wedepohl.*** *Philosophical Magazine*, v. 3, ser. 8, Nov. 1958, p. 1280-1286.

3379 Resonance Theory of Neutron Cross Sections of Fissionable Nuclei. The general Wigner-Eisenbud resonance theory is used to develop a method of analysis for the neutron cross sections of fissionable nuclei. The method is employed in giving a reasonable description of the low-energy cross sections in U^{233}. ***Erich Vogt.*** *Physical Review*, v. 112, ser. 2, no. 1, Oct. 1, 1958, p. 203-214.

3380 Tests for the Spin in the Decay of Particles of Arbitrary Spin. The polarization and angular distribution of a spin-½ particle produced in the decay of a fermion of arbitrary spin into two particles of spins 0 and ½, and in the decay of a boson of arbitrary spin into two different spin-½ particles, one of which is a two-component neutrino, are calculated in terms of the general decay amplitudes. The results are applied to the discussion of tests for the spin of the decaying particle. ***Jack Leitner.*** *Physical Review*, v. 112, ser. 2, no. 1, Oct. 1, 1958, p. 273-282.

3381 Production of Strange Particles and Antiparticles in Nuclear Interactions of Very High Energy (E ca. 10^{13} ev). The production of strange particles, nucleons, and antibaryons (antinucleons and antihyperons) in nuclear collisions of an energy between 10^{12} and 10^{14} ev was studied by looking for high-energy interactions produced by the secondary particles. The ratio of secondary interactions initiated by neutral particles to those initiated by charged particles was found to be $Q = 0.16 \pm 0.06$. Under reasonable assumptions, these data indicate that 9-6$^{+11}_{-6}$% of the high-energy charged secondary particles are charged K-mesons or baryons and antibaryons. The average energy of the primary collisions used in our analysis is estimated to the order of 10^{13} ev. ***E. Lohrmann and M. W. Teucher.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 387-389.

3382 Energies of Ground and Excited Nuclear Configurations in the First p½ Region. Shell-model analysis is applied to configurations containing both p½ and s½ nucleons. Energy levels of excited configurations (often recognized by their parity being opposite to that of the ground state) as well as binding energies are considered. Good agreement is obtained which gives support to the jj-coupling scheme. The results obtained are used for calculating other levels. In particular, the modes of excitation of the first excited O^- level in O^{16} and the ½-level in F^{19} are determined. ***I. Unna and I. Talmi.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 452-461.

3383 Gamma-Ray Threshold Method and the $O^{18}(d,n\gamma)F^{19}$ Reaction. A neutron threshold technique involving observations of the gamma rays from the de-excitation of the residual excited states is described. A study of the $O^{18}(d,n\gamma)F^{19}$ reaction with this technique has resulted in the observation of neutron thresholds at bombarding energies of 346 ± 8, 525 ± 8, and 584 ± 10 kev. These thresholds correspond to states at 6.048 ± 0.014, 6.210 ± 0.014, and 6.262 ± 0.015 Mev in the F^{19} nucleus respectively. A detailed gamma-ray spectrum was obtained at a bombarding energy of 1.00 Mev using a single-crystal spectrometer, and another detailed spectrum was obtained at 1.40 Mev using a three-crystal pair spectrometer. Coincidence measurements were made for several of the cascade gamma rays. ***J. W. Butler and H. D. Holmgren.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 461-467.

3384 Levels in Cr^{50}, Cr^{52}, Cr^{53}, and Cr^{54}. Inelastically scattered proton spectra from targets of natural chromium and targets enriched in Cr^{50}, Cr^{53}, and Cr^{54} have been studied for bombarding energies in the region of 4.3 to 4.6 Mev using a double-focusing magnetic spectrometer, at angles of observation of 91.5° and 136.2°. ***W. C. Porter, D. M. Van Patter, M. A. Rothman, and C. E. Mandeville.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 468-474.

3385 Elastic and Inelastic Scattering of Protons by N^{14}. Differential cross sections for the elastic scattering of protons by N^{14} have been measured for proton energies between 1.0 and 4.1 Mev at center-of-mass scattering angles of 90.0° and 168.1°. Above 3.5 Mev the study was extended to four additional angles, 140.8°, 125.3°, 54.7°, and 39.2° to provide information on a broad resonance near 3.9 Mev and a narrower resonance at 3.980 Mev. These two resonances also exhibit a measurable width for inelastic scattering to the first excited state of N^{14} at 2.31 Mev. ***J. W. Olness, J. Vorona, and H. W. Lewis.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 475-480.

3386 Inner Beta Spectra of Ag^{111} and Rb^{86}. The relatively high comparative half-lives of the low-energy, inner beta-ray group of Ag^{111} and the inner group of Rb^{86} suggest that their spectra may have nonstatistical shapes. The spectra were investigated with a 4π beta-ray scintillation spectrometer which had been adapted for beta-gamma coincidence studies. Both spectra are found to exhibit nonstatistical shapes. ***R. L. Robinson and L. M. Langer.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 481-485.

3387 Neutron Nonelastic Cross-Section Measurements on Carbon. Neutron nonelastic cross sections for carbon have been measured over the energy range from 5.8 to 12.9 Mev. The main features of the carbon nonelastic cross section as a function of neutron energy are a gradual rise from threshold (4.8 Mev) up to 7 Mev, a step rise from 7 to 8 Mev, and an approximately constant value from 8 to 14 Mev. In the vicinity of sharp resonances in the total cross section, good cross-section determinations are difficult to obtain using present-day sphere transmission techniques. ***M. H. MacGregor and Rex Booth.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 486-487.

3388 Compound-Nucleus Processes for the Reaction U^{235} + *n*. The neutron capture and inelastic scattering cross section of U^{235} are calculated on the basis of the statistical theory of nuclear reactions in the energy region up to 1.1 Mev. To carry out the program, one uses experimental data from the resonance region including the radiation width and the level spacing of the compound nucleus. One also makes use of the measured fission and total cross sections in the energy range considered, the spectrum of excited states of the target, and an exponential level-density law for the compound states. The agreement with experiment is good. ***E. R. Rae, B. Margolis, and E. S. Troubetzkoy.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 492-497.

3389 Boron Plus Deuteron Reactions. Gamma and alpha emission from the 15-Mev level of C^{12} is investigated in the reaction $B^{11}(_{d,n})C^{12}$. An upper limit on the ratio of α- to γ-radiation from the state is $G\alpha/G\gamma < 1.5$. The excitation threshold for 15-Mev gamma radiation is 1.633 ± 0.003 Mev, and the cross section is given as a function of bombarding energy up to 3.25 Mev. Resonances are found at 2.180 ± 0.010 and 3.080 ± 0.015 Mev. ***R. W. Kavanagh and C. A. Barnes.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 503-511.

3390 Alpha Decay of Deformed Even-Even Nuclei. Approximate analytic methods are developed for calculating the amplitudes of alpha partial waves at the surface of deformed even-even nuclei. A two-term expansion modifying the ordinary Coulomb function to account for nuclear quadrupole coupling is applied. The amplitudes of alpha partial waves at the nuclear surface are tabulated for eight choices of phase and three values of the intrinsic nuclear quadrupole moment. A detailed comparison is made between this treatment, that of Fröman, and the numerical integration of Rasmussen and Hansen for Cm^{242}. ***R. R. Chasman and J. O. Rasmussen.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 512-518.

3391 Precision Determination of Nuclear Energy Levels in Heavy Elements. The low-lying energy levels in 32 isotopes between Z=62 and Z=75 have been studied using a high-precision bent quartz crystal spectrograph to determine gamma-ray energies. The gamma rays were produced by the electric (or Coulomb) excitation process. The high proton-beam current of the A-48 accelerator was used to provide the intense sources necessary for these experiments. With this technique, energies in the 100-kev region can be determined with a precision of about one part in 2000. A comparison of the results with the unified model of nuclear structure is given. ***E. L. Chupp, J. W. M. DuMond, F. J. Gordon, R. C. Jopson, and Hans Mark.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 518-531.

3392 Re-Examination of the Paramagnetic Resonance of Np^{239}. The microwave paramagnetic resonance spectrum previously reported for 2.3-day Np^{239} activity incorporated into a crystal of $UO_2Rb(NO_3)_3$ has been re-examined and determined to be due, not to Np^{239}, but to radiation-induced resonance centers. Experiments tentatively suggest that these resonance centers may be Pu^{239} in an unusual oxidation state. An experiment in which Np^{239} nuclei were aligned by static hfs interactions (Pound and Bleaney methods) showed an anisotropy of the γ-ray pattern; this proves that the nuclear spin $I(Np^{239}) > \frac{1}{2}$, in contradiction to our earlier result. ***M. Abraham, C. D. Jeffries, R. W. Kedzie, and J. C. Wallmann.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 553-554.

3393 Splitting of the Giant Resonance for Deformed Nuclei. Photoneutron yield measurements have been made for terbium, tantalum, and gold with good energy resolution from threshold up to 25 Mev. Neutron-production cross sections were obtained directly from the experimental points without smoothing the raw data. Corrections were made for the multiple production of neutrons above the $(\gamma,2n)$ thresholds. The giant resonances for terbium and tantalum were found to be split into two resonances as predicted by Okamoto and Danos. ***E. G. Fuller and M. S. Weiss.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 560-567.

3394 Sum Rules for Inelastic Electron Scattering. Sum rules are constructed for the analysis of inelastic electron scattering at high energy (approx. 150 Mev) from light nuclei. Effects taken into account are: nucleon charge, recoil, and magnetic-moment currents; exchange currents; finite nucleon size; nuclear center-of-mass motion; and the kinematical factors describing the correct relation between initial and final electron energies, the scattering angle, and the nuclear excitation energy. ***S. D. Drell and C. L. Schwartz.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 568-579.

3395 Measurement of Electron Beam Energy Using a Gas Čerenkov Detector. It is shown that the energy of a monoenergetic beam of fast electrons can be accurately determined by using a variable pressure gas Čerenkov detector. A description of a simple detector of this type, and results taken with a 4½ Mev electron beam, are given. ***M. R. Bhiday, R. E. Jennings, and P. I. P. Kalmus.*** *Physical Society, Proceedings*, v. 72, Dec. 1958, p. 973-980.

3396 Elastic Scattering of Slow Ions in Their Parent Gases. Total elastic scattering cross sections for H^+, H^-, He^+, Ne^+, and A^+ in their parent gases are calculated for energies between 0.1 ev and 10 kev, by an impact parameter method. The Massey-Mohr approximation is used for the phase shifts. The cross sections vary as the square of the logarithm of the energy above 100 ev, but at some energy between this and 0.1 ev change to an inverse one-third power dependence. Approximate interaction energies for Ne_2^+ and A_2^+ at large R are

obtained from charge transfer data. ***M. R. C. McDowell.*** *Physical Society, Proceedings*, v. 72, Dec. 1958, p. 1087-1096.

3397 The Energy Levels of ^{31}P. I. γ-Ray Spectra and Decay Schemes. II. Angular Distributions and Correlations. III. Comparison With the Nilsson Model. Gamma-ray spectra have been studied at ten resonances in the reaction $^{30}Si(p,\gamma)^{31}P$ and decay schemes found by analysis of the spectra and coincidence experiments. ***C. Broude, L. L. Green, and J. C. Willmott.*** *Physical Society, Proceedings*, v. 72, Dec. 1958, p. 1097-1129.

3398 Double Scattering Experiments With 970 MeV Protons. Nuclear emulsions have been used as detectors to measure the asymmetries produced in a double scattering experiment using 970 MeV protons. Targets of beryllium and carbon have been used and angles between 3° and 8° investigated. Small but significant asymmetries have been found and the experiments are compared with others in this energy region. ***C. J. Batty and S. J. Goldsack.*** *Physical Society, Proceedings*, v. 72, Dec. 1958, p. 1130-1136.

3399* The Reaction $F^{19}(d,n)Ne^{20}$ and the Energy Levels of Ne^{20}. The energy spectra of neutrons emitted in the reaction $F^{19}(d,n)Ne^{20}$, produced by the 2.17 MeV deuteron, were measured with nuclear plates disposed at angles of 0 to 165°, with respect to the incident deuteron, at intervals of 15°. The general features of the spectra were consistent with the evaporation model. ***Susumu Morita and Kenji Takeshita.*** *Physical Society of Japan, Journal*, v. 13, Nov. 1958, p. 1241-1247.

3400* Differential Elastic Scattering of 14 MeV Neutrons in Aluminum, Iron, Lead and Bismuth for Large Angles. The absolute differential cross sections for the elastic scattering of 14 MeV neutrons in Al, Fe, Pb, and Bi have been measured for large angles up to 170°. The neutrons generated by $^{3}T(d,n)^{4}He$ reactions were scattered by the disk-shaped scatterer, and counted by the n-α coincidence circuit with the resolving time of 4 ns. An anticoincidence method was used to reduce the accidental coincidences between the α-particles and the neutrons which run directly to the detector from the target. ***Kazunori Yuasa.*** *Physical Society of Japan, Journal*, v. 13, Nov. 1958, p. 1248-1258.

3401 The Physics of Intermediate Spectrum Reactors. This is the third volume of the Naval Reactors Physics Handbook, sponsored by the Naval Reactors Branch of the Atomic Energy Commission. Covers investigation of reactor characteristics by critical assemblies; reactivity effects associated with reactor operation; heat generation and nuclear materials problems; and reactor kinetics and temperature coefficients. ***J. R. Stehn, editor.*** 38 chapters separately paged. 1958. U. S. Atomic Energy Commission. (QC787.N8 N22 Over.)

3402 Proceedings of a Meeting on Reactor Fuel Technology, May 6-7, 1958. Contains 12 transactions covering enriched and natural uranium systems; blanket fuel systems; oxide fuel elements; metal and alloy fuel elements; and fuel cladding and canning materials. ***Edwin A. Wiggin, editor.*** 120 pp. 1958. The Atomic Industrial Forum, Inc., New York. (TK9360 At71p Over.)

3403* Relativistic Wave Equations With Maximum Spin Two. Tensor equations are derived from the canonical form of relativistic wave equations. ***Toshihiko Tsuneto and Izuru Fujiwara.*** *Progress of Theoretical Physics*, v. 20, no. 4, Oct. 1958, p. 439-456.

3404* Effect of the Non-Relativistic Recoil of a Source Particle in Quantum Field Theories. Develops a calculation method convenient for the treatment of polaron-like systems, that is, the systems of a quantized field and a non-relativistically moving particle which are interacting fairly strongly with each other. ***Jun'ichi Osada and Haruyuki Fujino.*** *Progress of Theoretical Physics*, v. 20, no. 4, Oct. 1958, p. 487-504.

3405* Tensor and Spin-Orbit Forces in Nucleon-Nucleon Scattering. In order to investigate effects of a tensor force and to examine necessity of introducing a spin-orbit force at high energies, nucleon-nucleon scattering at 150 Mev is analyzed. The analysis is made taking into account some characteristic features of the pion-theoretical nuclear forces. ***Ryozo Tamagaki.*** *Progress of Theoretical Physics*, v. 20, no. 4, Oct. 1958, p. 505-528.

3406* Reactor Core Materials. A review of recent developments in solid materials for reactor cores. ***R. W. Dayton and E. M. Simons.*** *Reactor Core Materials*, v. 1, no. 4, Nov. 1958, 44 pp.

3407 The Binding Energies of Atomic Nuclei. I. Introduction and General Method. A preliminary study is made of various methods for determining the matrix elements of the effective interaction and the relative wave functions. ***R. J. Eden and V. J. Emery.*** *Royal Society, Proceedings*, v. 248, ser. A, Nov. 11, 1958, p. 266-281.

3408* Radioactive Wastes. Wastes may be "locked" in ceramic for safe burial, if experimental process proves a success. ***C. W. Phillips.*** *SAE Journal*, v. 66, Dec. 1958, p. 53.

3409 The Brookhaven Alternating Gradient Synchrotron. ***R. A. Beth and C. Lasky.*** *Science*, v. 128, Dec. 5, 1958, p. 1393-1401.

3410* Weakest-Link Method Helps System Design for Radiation Environments. Though designing for nuclear environments is still in its early stages, much has been learned about radiation effects on materials and parts. This article sums up the knowledge gained to date and explains a design method for radiation-proof accessory systems. ***H. R. Dvorak.*** *Space/Aeronautics*, v. 30, no. 6, Dec. 1958, p. 20 + 5 pages.

3411 Shielding-Research Area at Battelle. The design and construction of the shielding facility at Battelle is described in this report. ***Walter R. Morgan, Harold M. Epstein, James N. Anno., Jr., and Joel W. Chastain, Jr.*** *U. S. Atomic Energy Commission, BMI*-1291, Sept. 18, 1958, 28 pp. (UF767 U3b Contin.)

3412 Proceedings of the French-American Conference on Graphite Reactors. *U. S. Atomic Energy Commission, BNL*-489 (C-27), Nov. 12-15, 1957, 304 pp. (UF767 Un3.1bn Contin.)

3413 Radiation Damage Studies Program. ETR Loop Materials Progress Report III. This report summarizes the results of physical tests on irradiated materials that have some attraction for use in high-pressure equipment intended for operations in the reactor. ***H. T. Watanabe.*** *U. S. Atomic Energy Commission, IDO*-16475, Sept. 15, 1958, 68 pp. (UF767 Un3.1id Contin.)

3414* The Nuclear Quadrupole Moment of Mn^{55}. Investigation of the Mn-I spectrum in the 2800 to 5500 Å range by means of a Fabry-Perot interferometer. Determination of the quadrupole coupling constants of four therms. Thus the nuclear quadrupole moment of Mn^{55} is $(0.3 \pm 0.1)\cdot 10^{-24}$ cm^2. (*In German.*) Das Kernquadrupolmoment des Mn^{55}. ***Hans R. Rottmann.*** *Zeitschrift für Physik*, v. 153, no. 2, 1958, p. 158-163.

3415* Calorimetric Measurement of the Gamma-Rays Energy Flow From a Synchrotron. Special features of design and operation of the calorimeter adaptable for measurements of energy flows of γ-radiations with a spectrum limit up to 500 Mev. Result of measurements of bremsstrahlung γ-radiation energy flow from a synchrotron at three maximum energies (E max.). (*In Russian.*) Kalorimetricheskoe izmerenie potoka energii γ-luchei ot sinkhrotrona. ***S. P. Kruglov.*** *Zhurnal Tekhnicheskoĭ Fiziki*, v. 28, no. 10, Oct. 1958, p. 2310-2323.

3416* Grapho-Analytical Tracing of Charged Particle Paths in Electrostatic and Magnetic Fields. Three grapho-analytical methods: method of increment of velocities, method of radii of curvature, and the combination method. Analysis of the methods' basic errors and ways of their correction. (*In Russian.*) Grafoanaliticheskie postroeniia traektoriĭ zariazhennykh chastits v elektrostaticheskikh i magnitnykh poliakh. ***N. I. Shtepa.*** *Zhurnal Tekhnicheskoĭ Fiziki*, v. 28, no. 11, Nov. 1958, p. 2587-2603.

See also: **2533** (systems KF-UF_4 and RbF-UF_4); **2575** (heavy water production); **2803** (nuclear pulse height analysis); **3063** (corrosion designing for pressurized water reactors); **3173** (powder metallurgy of Be); **3175** (radiation effects on steel); **3322** (nuclear power plants).

OPERATIONS RESEARCH AND MANAGEMENT ENGINEERING

3417 The Gentle Art of Simulation. Mathematical simulation as an example of a new management device for decisions. *Business Week*, no. 1526, Nov. 29, 1958. p. 73 + 4 pages.

3418 Production Control by Electronic Computer. Describes an attempt to replace human judgment by routine calculation in deciding how the productive resources of a chemical factory are to be allocated. ***A. Battersby.*** *Chemistry & Industry*, 1958, no. 46, Nov. 15, p. 1488-1493.

3419 Metallurgists and Managers. Problems and factors affecting relations between management and scientific employees. ***H. W. G. Hignett.*** *Metal Industry*, v. 93, Nov. 21, 1958, p. 429-431.

3420 Operational Research and Advertising: Some Experiments in the Use of Analogies. Concerns the relationship between the amount of advertising and the response to it; a number of different analogies are employed to assist in the consideration of this relationship. ***B. Benjamin and J. Maitland.*** *Operational Research Quarterly*, v. 9, no. 3, Sept. 1958, p. 207-217.

3421* A Dynamic-Programming Computational Procedure for Optimal Manpower Loading in a Large Aircraft Company. A dynamic-programming model is developed for the determination of optimal manpower schedules in a large aircraft plant. The basic model consists of a cost equation representing the weekly costs of obtaining and utilizing the various categories of personnel. ***Albert B. Bishop and Thomas H. Rockwell.*** *Operations Research*, v. 6, no. 6, Nov.-Dec. 1958, p. 835-848.

3422 Can Operations Research Help You? Definition and characteristics of operations research. Wartime applications; indirect factors to consider; action based on circumstances. ***Steve Dembicki.*** *Pulp and Paper Magazine of Canada*, v. 59, Dec. 1958, p. 119-120.

3423* The Evaluation of Weapon Systems—An Example of Operations Research. Concepts and techniques of weapon systems evaluation and its relation to operations research. The role of weapon systems evaluation is discussed. ***Sidney Dickman.*** *Sperry Engineering Review*, v. 11, no. 4, Dec. 1958, p. 23-29.

3424* On a Distribution for the Number of Spoiled Articles in Shipments. The explicit form of a distribution for the number of spoiled articles in shipments is derived in this paper for one special type of problem in acceptance control. (*In Russian.*) Ob odnom sluchae raspredeleniia chisla defektnykh edinits v partiiakh izdelii. ***Kh. B. Kordonskii.*** *Teoriia Veroiatnostei i ee Primeneniia*, v. 3, no. 3, 1958, p. 354-358.

ORE AND MATERIALS BENEFICIATION

3425 Sintering Plant Now in Operation at the Ashland Works. Built primarily to agglomerate iron ore from Labrador, the installation will also be used to reclaim large stockpiles of flue dust and sludge. *Blast Furnace and Steel Plant*, v. 46, Dec. 1958, p. 1297-1300.

3426 How High Tension Electrostatic Separation Recovers Iron Ore. A process wherein no water is required and no modifying roasting is necessary. ***R. E. Barthelemy.*** *Engineering and Mining Journal*, v. 159, Dec. 1958, p. 87-91.

3427 Recovery of Uranium From Chattanooga Shale. A sulfuric acid leach of the raw shale proved most successful, two methods of which were applicable. ***F. Z. Pollara, et al.*** *Industrial and Engineering Chemistry*, v. 50, Dec. 1958, p. 1750-1753.

3428 Processing of Monazite Sands. By a combination of precipitation, ion exchange, and solvent extraction very pure Th, U, Ce, and rare earth products may be obtained in high yield. A final Th product containing no U is obtained, which is important if breeder Th is desired. ***John Barghusen, Jr. and Morton Smutz.*** *Industrial and Engineering Chemistry*, v. 50, Dec. 1958, p. 1754-1755.

3429 Uranium Recovery From Magnesium Fluoride Slag. Carbonate Leaching. Process involves grinding the slag, air roasting, dissolving the U in a carbonate-bicarbonate leach solution in the presence of an oxidizing agent, $KMnO_4$, and finally precipitating a polyuranate from the filtered leach solution by addition of caustic. ***R. G. Werkema and G. P. Lang.*** *Industrial and Engineering Chemistry*, v. 50, Dec. 1958, p. 1781-1784.

3430 Iron Ore. A review including tables, grades and analyses, and average analyses of ores. 120 pp. 1957. American Iron Ore Association, Cleveland. (TN403.A5 Am35i)

3431* Study of the Effect of Flotation Reagents on the Varieties of Zinc Blende by the Method of Potential Measurement. Study of changes occurring on the surface of zinc blendes of various chemical composition under the effect of flotation reagents, using method of measuring the electrochemical potential. This method permits a precise registration of physico-chemical changes of the mineral surface. (*In Russian.*) Izuchenie deĭstviia flotatsionnykh reagentov na raznovidnosti tsinkovykh obmanok metodom izmereniia potentsiala. ***D. I. Kogan and S. M. Iasiukevich.*** *Izvestiia Vysshikh Uchebnykh Zavedenii, TSvetnaia Metallurgiia*, 1958, no. 4, p. 47-55.

3432* Investigation of Gypsum Reduction and Its Stability Under the Conditions of Ore Shaft Smelting. Study of the behavior of chemically pure and natural gypsum in reducing and oxidizing mediums depending on gypsum composition, its screen size, and temperature of the medium. (*In Russian.*) Issledovanie vosstanovleniia gipsa i ego ustoĭchivosti v usloviiakh shakhtnoĭ plavki rud. ***D. I. Lisorskii.*** *Izvestiia Vysshikh Uchebnykh Zavedenii, TSvetnaia Metallurgiia*, 1958, no. 4, p. 73-82.

3433* Mineralogy of Fusion Products of Gold-Bearing Ores and Concentrates of Some Ore Deposits in Eastern Siberia. Study of the composition of slags obtained in experimental matte smelting of the gold-bearing ores and concentrates. Investigation of the slags by means of a study of transparent and polished sections in reflected and transmitted lights using microchemical reactions and etching. (*In Russian.*) Mineralogiia produktov plavki zolotosoderzhashchikh rud i kontsentratov nekotorykh mestorozhdeniĭ vostochnoĭ sibiri. ***G. V. Khetaguров.*** *Izvestiia Vysshikh Uchebnykh Zavedenii, TSvetnaia Metallurgiia*, 1958, no. 4, p. 119-121 + 2 plates.

3434* Elimination of Harmful Action of Flotation Reagents in the Cyanide Process of a Concentration. Study of the effect of froth formation obtained in the flotation stage of ore concentration, on gold dissolving in the cyanide solution. Elimination of the harmful effect was accomplished by introducing an operation of wash-off flotation reagents in the cyanide process, or by modifying design of mixing tanks. (*In Russian.*) Ustranenie vrednogo deĭstviia flotoreagentov pri tsianirovanii kontsentrata. ***S. B. Leonov, V. R. Khokhlov, and S. V. Bessonov.*** *Izvestiia Vysshikh Uchebnykh Zavedenii, TSvetnaia Metallurgiia*, 1958, no. 4, p. 122-123.

3435* Convenience, According to Heat Balances, of Old and New Systems for the Matte Extraction From Copper Ores. Several systems are described and analyzed. (*In Italian.*) Convenienza, in base a bilanci termici, di sistemi vecchi e nudvi per l'estrazione della metallina da minerali di rame. ***G. Porro.*** *Metallurgia Italiana*, v. 50, Oct. 1958, p. 453-460.

3436* Direct Reduction of Iron Ores in a Rotary Kiln. Solid carbon fuels containing up to 7.5% S have been successfully utilized to produce metallic iron briquettes containing greater than 90% iron, less than 3% silica, and less than 0.05% S. ***Alex Stewart.*** *Mining Congress Journal*, v. 44, Dec. 1958, p. 34 + 5 pages.

3437* Chlorination of Fine Ores During Sintering. Adverse effects caused by residual elements in the iron smelting process. Enrichment of the pig iron in foreign elements when processing concentrates, calcined pyrites, and dust and sludge from blast furnace plants. Elimination by chlorination. Chlorinating fine ores containing much zinc on an experimental sintering pallet. (*In German.*) Die chlorierende Behandlung von Feinerzen beim Sinterverfahren. ***Herbert Neuhaus and Her-***

mann Schenck. *Stahl und Eisen*, v. 78, no. 23, Nov. 13, 1958, p. 1662-1670.

3438* Self-Grinding of Ores in Milling at Supercritical Speeds. A comparative analysis of various principles for increasing the effectiveness of crushing and grinding operations. Relationships between motion of falling bodies and mill diameter. Investigation of impact crushing, and grinding by attrition in a rotating mill. (*In Russian.*) Samoizmel'chenie rud pri sverkhkriticheskikh skorostiakh vrashcheniia mel'nits. ***R. T. Khukki.*** *Tsvetnye Metally*, v. 31, no. 11, Nov. 1958, p. 9-16.

3439* Study of the Behavior and Recovery of Rhenium in a Furnace for Fluo Solid Roasting of Molybdenite Concentrates. Studying distribution of Re during roasting, and recovery of Re in a bubbling plant. Chemical composition of concentrates and roasting temperature conditions. Design of a bubbler and a laboratory-scale furnace for fluo-solid roasting of concentrates assuring 92 to 96% recovery of Re. (*In Russian.*) Izuchenie povedeniia i ulavlivaniia reniia pri obzhige molibdenitovykh kontsentratov v pechi kipiashschego sloia. ***A. N. Zelikman, et al.*** *Tsvetnye Metally*, v. 31, no. 11, Nov. 1958, p. 47-52.

3440* Moistening the Froth to Improve the Results of Flotation. Investigation of a simple and efficient method of sprinkling the froth with water during flotation. Effect of the moistening on distribution of mineral grains along the width of froth layer; effect of the amount of consumed water during moistening on the composition of concentrates and tailings, and on the output of grain sizes larger than 74μ. Moistening makes it possible to increase not only the concentrate quality, but also the recovery. (*In Russian.*) Primenenie oroshcniia peny dlia uluchsheniia rezul'tatov flotatsii. ***N. Ia. Gershgal, S. A. Zaremba, and E. G. Lisovetskaia.*** *Tsvetnye Metally*, v. 31, no. 11, Nov. 1958, p. 82-84.

PHYSICS

3441* A Wave Guide for Surface Waves of Liquids. A simple theory for an ideal liquid with disappearing outer friction: the paths of the infinitesimal liquid particles are always ellipsoidal. The surface of the liquid in the medium exhibits periodical rises and depressions very similar to the field distribution pattern in electromagnetic tubular conductors. (*In German.*) Ein Wellenleiter für Oberflächenwellen von Flüssigkeiten. ***Othmar Preining.*** *Acta Physica Austriaca*, v. 12, no. 2, Oct. 1958, p. 172-186.

3442 The Properties of the Saturated Helium Film. In this article an account will be given of the known properties of the relatively thick film which covers all solid surfaces in contact with liquid helium II or with the saturated vapor in equilibrium with the liquid. The information, as yet rather meager, available on the properties of the film which exists above the λ-point will also be discussed. ***L. C. Jackson and L. G. Grimes.*** *Advances in Physics*, v. 7, no. 28, Oct. 1958, p. 435-478.

3443* Thermodynamics of Superconductors. Studying the thermodynamics of superconductors by means of Fröhlich's hamiltonian (in which the phonon-electron interaction is evidently considered) using the thermodynamic theory of excitation. (*In Russian.*) Termodinamika sverkhprovodnikov. ***D. N. Zubarev and Iu. A. Tserkovnikov.*** *Akademiia Nauk SSSR, Doklady*, v. 122, no. 6, Oct. 21, 1958, p. 999-1002.

3444* On the Theory of the Formation of Multiple Elementary Excitations. Calculation of the output of the multiple process using Fermi's statistical method, based on an assumption of an equal excitation of all possible final states according to the principle of conservation. Probability of given output is connected with the number of states, affected by this output, that is, with its statistical weight. (*In Russian.*) K teorii mnozhestvennogo obrazovaniia elementarnykh vozbuzhdenií. ***V. T. Khoziainov.*** *Akademiia Nauk SSSR, Doklady*, v. 122, no. 6, Oct. 21, 1958, p. 1003-1006.

3445* The Role of Surface Properties of Semiconductors in Adhesion Phenomena. Basic points of the analysis of surface states on the metal-semiconductor boundary. Investigation of donor-acceptor chemical bond, and consideration of the effect of functional donor or acceptor groups introduced on the surface. (*In Russian.*) Rol' poverkhnostnykh svoĭstv poluprovodnika v iavleniiakh adgezii. ***V. P. Smilga and B. V. Deriagin.*** *Akademiia Nauk SSSR, Doklady*, v. 122, no. 6, Oct. 21, 1958, p. 1049-1052.

3446* Polarization of Luminescence of Excitation by Polarized and Natural Light. Study of isotropic solutions and cubic crystals in which the degree of polarization depends on the state of polarization of the exciting light. Calculations for electric and magnetic dipoles, electric quadrupoles, electric and magnetic circular oscillators. Observation of the polarized luminescence in three different cases of orientation of an elementary oscillator: along the axes of fourth, third and second order. (*In Russian.*) Poliarizatsiia liuminestsentsii pri vozbuzhdenii poliarizovannym i estestvennym svetom. ***A. N. Savchenko and G. P. Gurinovich.*** *Akademiia Nauk SSSR, Doklady*, v. 123, no. 1, Nov.-Dec. 1958, p. 60-63.

3447* Relationship Between Absorption and Luminescence Spectra of Polyatomic Molecules. Solution of the problem of basic relationships between molecular absorption and luminescence spectra, based on certain necessary relationships between absorption and emission spectra, for systems being in thermal equilibrium, is used for investigation of non-equilibrium processes, for instance luminescence. The scheme of such solution of the problem for a system with two electron states, normal and excited, is briefly reviewed. (*In Russian.*) Sviaz' mezhdu spektrami pogloshcheniia i liuminestsentsii mnogoatomnykh molekul. ***B. S. Neporent.*** *Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia*, v. 22, no. 11, Nov. 1958, p. 1372-1376.

3448* Method of Quasi-Normal Coordinates in Crystal Optics. General principles of the method and its application for ion crystals with NaCl type lattice. (*In Russian.*) Metod kvazinormal'nykh koordinat v optike kristallov. ***V. S. Mashkevich.*** *Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia*, v. 22, no. 11, Nov. 1958, p. 1308-1311.

3449* Light-Scattering by Charged Dislocations in Ionic Crystals. The temperature dependence of light-scattering by single crystals of sodium chloride and potassium chloride is investigated in the temperature region between 168 K and 350 K. ***C. A. Plint, O. Theimer, and W. A. Sibley.*** *Annals of Physics*, v. 5, Dec. 1958, p. 342-356.

3450* On Exterior Boundary Value Problems in Linear Elasticity. ***R. J. Duffin and Walter Noll.*** *Archive for Rational Mechanics and Analysis*, v. 2, no. 2, Oct. 31, 1958, p. 191-196.

3451* Multi-Phonon Processes in Slow Neutron Scattering by Crystals. Assumes harmonic approximation for the crystal vibrations. The differential scattering cross section is expanded in the Hermite orthogonal functions and approximate expressions for the cross section are derived. ***Alf Sjölander.*** *Arkiv för Fysik*, v. 14, no. 4, 1958, p. 315-371.

3452* On the Composite Polarization of Light. Study of two sources of light differently polarized, but observed simultaneously in the same direction. (*In Russian.*) O summarnoĭ poliarizatsii sveta. ***V. G. Fesenkov.*** *Astronomicheskiĭ Zhurnal*, v. 35, no. 5, Sept.-Oct. 1958, p. 681-686.

3453* On Some Peculiarities of the Magneto-Decelerating Mechanism of Non-Thermal Radio Emission. Study of the movement of cosmic electrons in an interstellar magnetic field. Consideration of the possibility of formation of relativistic electrons as a result of non-reversible collisions of relativistic protons with atoms of the interstellar medium. (*In Russian.*) O nekotorykh osobennostiakh magnitnotormoznogo mekhanizma neteplovogo kosmicheskogo radioizlucheniia. ***G. G. Getmantsev.*** *Astronomicheskiĭ Zhurnal*, v. 35, no. 5, Sept.-Oct. 1958, p. 722-729.

3454 The Stability of Couette Flow in an Axial Magnetic Field. Chandrasekhar's theory of the stability of viscous flow of an electrically conducting fluid between coaxial rotating cylinders with perfectly conducting walls is extended to include the case of non-conducting walls, and it is found that their effect is to reduce the critical Taylor numbers and increase the wavelength of the instability patterns by considerable amounts. ***E. R. Niblett.*** *Canadian Journal of Physics*, v. 36, Nov. 1958, p. 1509-1525.

3455 Polarization Fluctuations in a Ferroelectric Crystal. The theory of thermal fluctuations of electrical polarization in a ferroelectric crystal is considered with special attention to temperatures in the neighborhood of the Curie point. ***R. E. Burgess.*** *Canadian Journal of Physics*, v. 36, Nov. 1958, p. 1569-1581.

3456 The Resolution Correction in the Scintillation Spectrometry of Continuous X Rays. Analytical solutions are given to the integral equation which describes the effect of the statistical spread in pulse height. The practical necessity of making some kind of numerical analysis is pointed out. ***W. R. Dixon and J. H. Aitken.*** *Canadian Journal of Physics*, v. 36, Dec. 1958, p. 1624-1633.

3457* The Dielectric Constant of Molecules Containing Hydrogen Bonds. Study of the dielectric constant of molecules containing hydrogen bonds, the energy surfaces of which have two symmetrical minima. (*In French.*) Sur la constante dielectrique des molecules contenant des liaisons hydrogene. ***Savo Bratoz.*** *Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences*, v. 247, no. 22, Dec. 1, 1958, p. 1968-1970.

3458 Iron Wire Exploration of Alternating or Constant Magnetic Fields. The use of a bit of iron wire to find the flux lines of an alternating field may be new. The writer has found no one who has heard of such a technique. It also may be used on constant fields. It enables one to lay out continuous flux lines with speed and simplicity. ***A. D. Moore.*** *Electrical Engineering*, v. 77, Dec. 1958, p. 1124-1126.

3459 Ultrasonic Absorption in Aqueous Butyric Acid Solutions. Ultrasonic absorption has been measured in aqueous butyric acid solutions in the frequency range 1 to 7 Mc/sec and between 0 and 60 C by a pulse technique. At constant temperature the absorption exhibits a sharp maximum at approximately 12 mole % and at higher temperatures a broad maximum at 50 mole %. ***P. White, D. Moule, and G. C. Benson.*** *Faraday Society, Transactions*, v. 54, Nov. 1958, p. 1638-1645.

3460 The Penetration of Mercury and Capillary Condensation in Packed Spheres. The theory of mercury penetration and retraction in packings of uniform spheres has been developed. Hysteresis is predicted. The penetration branch is equivalent to the desorption branch in capillary condensation. The retraction branch is equivalent to the adsorption branch in capillary condensation. The penetration and retraction in packings of three samples of glass spheres with diameters between 1 and 0.2 mm. and of stainless steel balls ($d = 0.794 \pm 0.002$ mm.) was measured. The experimental results are in agreement with theory. ***S. Kruyer.*** *Faraday Society, Transactions*, v. 54, Nov. 1958, p. 1758-1767.

3461 Polarization Studies With Thorium Oxide. Studies of electrical polarization resulting from passage of current in single crystals of ThO_2 in the 600-1300 C region were extended to detailed measurements of the initial rate of rise of such polarization. An attempt is made to deduce therefrom the density and mobility of charge carriers. Existing theoretical papers on the subject are briefly discussed. Reasonable values of carrier density are obtained but mobility values appear to be too low and to vary with temperature in the wrong sense. ***W. E. Danforth.*** *Franklin Institute, Journal*, v. 266, no. 6, Dec. 1958, p. 483-491.

3462 An Introduction to Statistical Mechanics. Basically the ensemble method, introduced by a modification of the Darwin-Fowler method, is used and an attempt has been made to render this method intelligible to the student with limited mathematical knowledge. The main approximation method used has been explained in outline only in the text. ***J. S. R. Chisholm and A. H. de Borde,*** v. 2, 160 pp. 1958. Pergamon Press, New York. (QC175 C44i)

3463* The Correlations in a Plasma in Equilibrium. Attempts to review the calculation of spatial correlations in such a plasma. The equations of recurrence and the principle of superposition are used. (*In French.*) Les corrélations dans un plasma en équilibre. ***J. Yvon.*** *Journal de Physique et le Radium*, v. 19, Oct. 1958, p. 733-738.

3464 Analysis of the Thermoelectric Effects by Methods of Irreversible Thermodynamics. By means of the thermodynamics of irreversible processes, three thermoelectric quantities, namely, the Thomson coefficient, the Peltier coefficient, and the electromotive force of a thermocouple, are each expressed in terms of a pure temperature function h which is the difference between the isothermal energy flux in a conductor per unit electrical current and the electrochemical potential of the unit electrical charge. The Kelvin relations for the thermocouple follow directly. ***G. N. Hatsopoulos and J. H. Keenan.*** *Journal of Applied Mechanics*, v. 25, no. 4, Dec. 1958, p. 428-432.

3465 Nuclear Magnetic Resonance Absorption in Glass. I. Nuclear Quadrupole Effects in Boron Oxide, Soda-Boric Oxide, and Borosilicate Glasses. ***A. H. Silver and P. J. Bray.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 984-990.

3466 Molecular Collisions. I. Formal Theory and the Pauli Principle. The formal theory of scattering of Gell-Mann and Goldberger is used to obtain expressions for the differential cross sections describing collisions between two molecules with internal structure in terms of the asymptotic forms of the wave functions. The effect of the Pauli principle is considered explicitly. ***George Gioumousis and C. F. Curtiss.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 996-1001.

3467 Vibrational Intensities. X. Integration Theorems. The advantages of integrating absorption intensities against the logarithm of the frequency, rather than against the frequency itself, are presented. ***Bryce Crawford, Jr.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 1042-1045.

3468 Effect of Electrostatic Fields on the Orientation of Colloidal Particles Immersed in Shear Flow. The orientation distribution function for rigid colloidal particles immersed in Couette flow with an electric field parallel to the velocity gradient is derived in this study. Simple streaming birefringence experiments with variable or constant electric fields can be devised to test this theory which promises to yield a new method for measuring some geometrical and physical properties of colloidal particles. ***S. T. Demetriades.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 1054-1063.

3469 Evidence for the Triplet State in Photoconductivity in Anthracene. Some evidence is presented indicating that the formation of a triplet state is involved as an intermediary step in the creation and transfer of charges in the photoconduction process in organic substances. On the basis of the simple potential curve picture, approximate solutions are obtained to the rate process equations. These equations predict that the density of the triplet states under thermal and optical equilibrium conditions will follow a Boltzmann exponential dependence upon temperature with an energy equal to a low multiple (1 or 2) of the vibrational spacing of the excited singlet state. ***Barnett Rosenberg.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 1108-1118.

3470 On the Statistical Mechanical Theory of Solutions. A perturbation expansion of the excess free energy of a binary mixture based on the theory of composition fluctuations in an open system is presented. The theory is applied to classical mixtures and quantum mechanical isotope mixtures, and comparisons with conformal solution theory and Chester's theory of isotope mixtures are made. ***R. M. Mazo.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 1122-1128.

3471 Molecular Diffusion Studies in Gases at High Temperature. I. The "Point Source" Technique. II. Interpretation of Results on the He—N_2 and Co_2—N_2 Systems. ***R. E. Walker and A. A. Westenberg.*** *Journal of Chemical Physics*, v. 29, Nov. 1958, p. 1139-1153.

3472* The Effect of Heat Treatment on the Breakdown Characteristics of Silicon pn Junctions. An explanation for this effect is suggested. ***A. R. Plummer.*** *Journal of Electronics and Control*, v. 5, no. 5, Nov. 1958, p. 405-416.

3473* Photochemical Effects and the Effect of Oxygen on Photoconducting Cadmium Sulphide Crystals. Accounts for some aspects of the photochemical decay and the effects of

heat treatment in oxygen. ***J. Woods.*** *Journal of Electronics and Control*, v. 5, no. 5, Nov. 1958, p. 417-426.

3474* On the Diffraction and Reflection of Waves and Pulses by Wedges and Corners. Various problems arising in the theory of the excitation of a perfectly reflecting wedge or corner by a plane, cylindrical, or spherical wave, are dealt with. The incident wave is represented by a line source (acoustic or electromagnetic) parallel to the edge. The spherical wave is emitted by an acoustic point source or by a Hertz dipole with its axis parallel to the edge. The case of an incident plane wave field is obtained as the limiting case (for large distances of the source from the edge) of the cylindrical or spherical wave excitation. ***F. Oberhettinger.*** *Journal of Research, National Bureau of Standards*, v. 61, no. 5, Nov. 1958, p. 343-365.

3475* The Second Spectrum of Ruthenium (Ru II). Wavelengths and estimated intensities of 2,227 spectral lines characteristic of singly ionized ruthenium atoms are presented. The wavelengths range from 1054.684 to 6371.29 A. The Zeeman effect has been investigated for 488 lines ranging from 2323 to 4010 A. ***Allen G. Shenstone and William F. Meggers.*** *Journal of Research, National Bureau of Standards*, v. 61, no. 5, Nov. 1958, p. 373-411.

3476* Effect of Thermal Properties of a Solid on the Velocity of Rayleigh Waves. ***F. J. Lockett.*** *Journal of the Mechanics and Physics of Solids*, v. 7, no. 1, Nov. 1958, p. 71-75.

3477* Relative Scintillation Efficiencies of Noble Gas Mixtures. An investigation has been made of the relative amounts of scintillation light emitted from mixtures of the noble gases during the 0.5 μ sec interval following the stopping of an α-particle. A bellows pump and a hot uranium furnace in a closed circulation system maintained gas purity. A diphenyl stilbene coating on the photomultiplier tube and the walls of the scintillation volume acted as a wavelength shifter for the primary ultraviolet radiation. Data on the efficiency of various proportions of binary combinations of xenon, krypton, argon, neon, and helium are presented. ***J. A. Northrop and Judith C. Gursky.*** *Nuclear Instruments*, v. 3, no. 4, Oct. 1958, p. 207-212.

3478* On Generalized Foldy-Wouthuysen Transformations. This paper discusses three problems concerning the approximate decoupling of the Dirac equation by means of successive unitary transformations. ***D. L. Pursey.*** *Nuclear Physics*, v. 8, no. 5, Nov. 1958, p. 595-601.

3479* Non-Local Structure of Field Theories With Non-Renormalizable Interaction. Shows that quantized field theories of the second kind, pertaining to derivative couplings, possess non-local structure. The full recoil neutral PS-PV theory in its non-linear form is discussed. ***W. Güttinger.*** *Nuovo Cimento*, v. 10, ser. 10, no. 1, Oct. 1, 1958, p. 1-36.

3480* On the Collective Properties of a Boson System. Minimizing the energy with respect to a trial ground state vector of exponential form, new equations and expressions are derived for the excitation spectrum of bosons. ***J. G. Valatin and D. Butler.*** *Nuovo Cimento*, v. 10, ser. 10, no. 1, Oct. 1, 1958, p. 37-54.

3481* An Investigation on Plasmas in External Magnetic Fields. I. Steady State. For a rare plasma, without particle collisions a method is developed by which a complete set of plasma equations is established. ***G. Schmidt.*** *Nuovo Cimento*, v. 10, ser. 10, no. 1, Oct. 1, 1958, p. 55-67.

3482* General Relativity: Relative Standard Mass, Momentum, Energy and Gravitational Field in a General System of Reference. Shows that the equations of the motion of a free test particle in general relativity theory, with respect to any physical system of reference, can always have the classical interpretation: time derivative of momentum = mass x gravitational field. ***C. Cattaneo.*** *Nuovo Cimento*, v. 10, ser. 10, no. 2, Oct. 16, 1958, p. 318-337.

3483 On a Comparison Between Wave Optics and Geometrical Optics by Using Fourier Analysis. III. Image Evaluation by Spot Diagram. In order to evaluate the image qualities of lenses quantitatively, it is shown that the geometric optical response function and the intensity distribution can be calculated directly from the coordinates of the spots. ***Kenyō Miyamoto.*** *Optical Society of America, Journal*, v. 49, Jan. 1959, p. 35-40.

3484 Optimum Concentration Effect in Raman Spectroscopy. Intensity-concentration data are given for a number of Raman lines. ***Ellis R. Lippincott, John P. Sibilia, and Robert D. Fisher.*** *Optical Society of America, Journal*, v. 49, Jan. 1959, p. 83-89.

3485 On the Thermal Expansion of Solids. It is pointed out that the thermal expansion coefficient of solids is not always zero even in ideally harmonic crystals, if one quantizes the phonon field. This apparently differs from the customary treatment which is essentially based on non-quantized phonon field model. ***Yasushi Takahashi.*** *Physica*, v. 24, Nov. 1958, p. 857-867.

3486 Thermal Conductivity of an Electron Gas in a Gaseous Plasma. The thermal conductivity of an electron gas in a gaseous plasma is determined. In the plasmas investigated, neon and helium, the degree of ionization is very low (10^{-5}-10^{-6}). However, the measured values of the thermal conductivity are still consistent with those obtained from the theoretical expression given by Landshoff, or Spitzer and Härm for a fully ionized gas. ***T. Sekiguchi and R. C. Herndon.*** *Physical Review*, v. 112, ser. 2, no. 1, Oct. 1, 1958, p. 1-10.

3487 Theory of the Dielectric Constants of Alkali Halide Crystals. The short-range repulsive interaction between ions with closed shell electron configurations is investigated, and an approximate interpretation of the Born-Mayer potential in terms of overlap integrals is developed. ***B. G. Dick, Jr. and A. W. Overhauser.*** *Physical Review*, v. 112, ser. 2, no. 1, Oct. 1, 1958, p. 90-103.

3488 Magnetically Confined Plasmas. The propagation of high-velocity shock waves in an axial magnetic field generated by single-turn coils connected in parallel to a condenser bank is investigated. Time-resolved photographs show that the plasma behind the shock front is driven away from the tube walls by the magnetic pressure. This compression heats the ionized gas and maintains a high shock velocity during the transit of the front through the coil. The compressed plasma appears to be stable and undergoes radial oscillations that follow the current oscillations. The interpretation and significance of these observations in controlled thermonuclear fusion research are discussed. ***A. C. Kolb.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 291-296.

3489 Absorption Spectrum of KCl:Tl at Low Temperatures. The ultraviolet absorption spectrum of thallium in single-crystal potassium chloride has been accurately measured down to 187 mμ at 295, 77, and 4 K. The asymmetry apparent in both major bands at room temperature disappears at low temperature. The existence of two kinds of singlet thallium centers in slightly different crystalline environments is suggested as a possible explanation. ***David A. Patterson.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 296-297.

3490 Infrared Absorption by Conduction Electrons in Germanium. A quantum mechanical theory of infrared absorption by conduction electrons in germanium due to intra-valley lattice scattering is developed which takes into account the multivalley structure of the conduction band as well as the present knowledge about intravalley lattice scattering. Within the framework of the deformation-potential theory the calculation can be performed without any serious approximations for all relevant wavelengths and all relevant temperatures. ***H. J. G. Meyer.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 298-308.

3491 Linear Antiferromagnetic Chain With Anisotropic Coupling. The energy of the antiferromagnetic ground state is computed and comparison is made with a variational method. The parameter α is allowed to vary between 0 and 1, regulating the relative amount of Ising anisotropy. ***R. Orbach.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 309-316.

3492 Magnetoresistance in *n*-Type Germanium at Low Temperatures. Magnetoresistance was studied for *n*-type single-crystal germanium of 4 x 10^{15} effective donors/cm^3. The effective anisotropy parameter K was found to decrease from approx. 20 at 300 K to approx. 6 at 20 K. Values close to 20 were again obtained at 7 K and 4.2 K. By introduction of compensating

acceptors with heat treatment, it was shown directly that the decrease of K was due to anisotropic scattering by ionized impurities, and the anisotropy was investigated by using different degrees of compensation. ***R. A. Laff and H. Y. Fan.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 317-321.

3493 Electron Energy Bands in Sodium. The potential energy of a valence electron in sodium is represented by the function $V(r) = 2/r + Ae^{-\beta r}/r$. The second term, which is repulsive in character, represents the effect of the core electrons. Values for A and β are determined from spectroscopic data. Energy levels of predominantly s and p symmetry are determined at four points of the Brillouin zone. ***Joseph Callaway.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 322-325.

3494 Magnetization Studies and Possible Magnetic Structure of Barium Ferrate III. An approach to the absolute saturation magnetization of polycrystalline, magnetically hard $BaO.6Fe_2O_3$ has been achieved by using magnetic fields up to 60,000 gauss and temperatures down to 1.3 K where the saturation magnetization and remanence (about one-half of the saturation magnetization) have become temperature-independent. The magnetization in the highest fields is approaching 1.64 Bohr magnetons per atom of Fe at 1.3 K and 1.13 at 295 K. Inferences are drawn as to a possible magnetic structure from such a saturation magnetization. A sample displacement ballistic technique is used. ***Warren E. Henry.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 326-327.

3495 Magnetic Susceptibility of an Electron Gas at High Density. The magnetic susceptibility of an electron gas at high density is determined using the exact theory of Gell-Mann and Brueckner. ***K. A. Brueckner and K. Sawada.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 328-329.

3496 Radiative Recombination in Germanium. The dependence of recombination radiation, U, on the excess carrier density, δp, and on the equilibrium carrier density, $(n_o + p_o)$, was studied in 0.2 to 12 ohm-cm n- and p-type germanium by simultaneous measurements of output radiation and of photoconductivity as functions of incident light intensity. The results confirm the van Roosbroeck-Shockley theory of band-to-band recombination. ***Patricia H. Brill and Ruth F. Schwarz.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 330-333.

3497 Cohesive Energy and Wave Functions for Rubidium. The cellular method was used to calculate the cohesive energy of rubidium. The potential was obtained from a self-consistent field for Rb^+ supplemented by an exchange potential. Wave functions were obtained to order k^2 in the solid and for the lowest valence electron state in the free atom. A value of 20.7 kcal/mole was obtained for the cohesive energy, including k^4 terms in the Fermi energy, but neglecting any polarization effects. ***Joseph Callaway and Daniel F. Morgan, Jr.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 334-336.

3498 Approximate Wave Functions for the U Center by the Point-Ion-Latticle Method. Wave functions for the ground state and the first excited state of the U center are calculated in the point-ion-lattice approximation, and the term values are obtained. The transition energy and the oscillator strengths are computed, and the former are compared with experimental data. They are approximately 20% smaller than the observed transition energies. A qualitative argument is presented, suggesting that this discrepancy can be removed by inclusion of the exchange energy. ***Barry S. Gourary.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 337-340.

3499 Temperature Dependence of the Characteristic Energy Loss of Electrons in Aluminum. The change in the 15-ev characteristic energy loss suffered by 15-kev electrons passing through a thin film of aluminum has been measured as a function of temperature from 4.2 K to 518 K. It is found that above room temperature the energy loss change agrees, within experimental error, with the change-expected due to decreased electron density resulting from expansion of the lattice. However, below room temperature the energy loss change is much greater than expected on the above basis. ***Lewis B. Leder and L. Marton.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 341-343.

3500 Energy Bands in Solids—The Quantum Defect Method. Describes a procedure for the calculation of electron energy bands in certain solids from spectroscopic data for the corresponding free atom. This method is an improved version of one used by Kuhn, and Van Vleck to calculate the energy bands of sodium, potassium, and rubidium. It avoids explicit construction of a one-electron potential to represent the interaction between the valence and core electrons. ***Harvey Brooks and Frank S. Ham.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 344-361.

3501 Surface Effects in Electron-Irradiated Ge at 80°K. Photoconductivity, surface conductance, Hall and field effect measurements have been made before and after electron irradiations. Before irradiation, both n- and p-type specimens show a photoconductive shoulder in the range of photon energies between 0.70 and 0.55 ev, which is connected with a surface effect. Irradiation with energies below the threshold for the introduction of volume defects (about 400 kev) quenches the photoconductivity in the shoulder and causes an increase in surface conductance in n-type, and a decrease in p-type specimens. 4.5-Mev irradiations (a) extend the shoulder to about 0.49 ev and (b) introduce a sharp peak at 0.39 ev. ***Walter E. Spear.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 362-369.

3502 Semiconductor Surface Potential and Surface States From Field-Induced Changes in Surface Recombination. Experiments are reported on the effects of ac electric fields and ambients on the surface recombination velocity in germanium and silicon. The variations in surface recombination are detected by changes in the reverse current of large area "back surface" diodes. The experimental method is an improved version of that of Thomas and Rediker and is a convenient means of exploring surface type, stability, time effects at the surface, and effects induced by high ac fields and ambients on the slow surface states. ***George C. Dousmanis.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 369-380.

3503 Photoconduction and Surface Effects With Zinc Oxide Crystals. Large photoconductive effects have been observed on single crystals of ZnO at 300 K and 78 K. At 300 K the decay of the photoconductivity is strongly dependent on the ambient conditions, being slow in vacuum and fast in wet oxygen. This shows that the conductivity is associated with the surface. The effects are essentially independent of the dark conductivity of the crystals and cannot be accounted for by the desorption of adsorbed oxygen. It is proposed that holes from hole electron pairs discharge lattice oxygen ions at the surface, producing a surface excess of zinc and an electron enrichment layer in which conduction occurs. ***R. J. Collins and D. G. Thomas.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 388-395.

3504 Low-Temperature Transition of Magnetic Anisotropy in Nickel-Iron Ferrite. A study of the magnetic properties of single crystal samples of nickel-iron ferrite with composition $Fe_{1.00}^{3+}[Ni_{0.79}^{2+}Fe_{0.90}^{3+}]O_4$ has revealed an abrupt transition in the magnetic anisotropy characteristics at 10 K. Above this temperature the anisotropy energy is small and has cubic symmetry; below 10 K the anisotropy energy increases rapidly with decreasing temperature and contains a uniaxial annealing term in addition to the cubic terms. ***Norman Menyuk and Kirby Dwight.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 397-405.

3505 Magnetic Anisotropy Constant of Yttrium Iron Garnet at 0°K. The anisotropy energy of yttrium iron garnet is separated into two parts, the normal part predominant at high temperatures, and the anomalous part important below 50 K. By comparison with ferrite data, the cause of the normal anisotropy is expected to be the coupling of the Fe^{3+} ions to the crystalline field. The following expression for K_1, the first-order anisotropy constant, as a function of the fine structure coupling constants a_{24} (tetrahedral sites) and a_{16} (octahedral sites) is obtained: K_1/unit cell $= -46.6a_{24} - 13.6a_{16}$. ***B. R. Cooper.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 395-396.

3506 Dielectric and Thermal Study of $(NH_4)_2SO_4$ and $(NH_4)_3BeF_4$ Transitions. The behavior of the various dielectric properties, specific heat, and thermal expansion of

$(NH_4)_2SO_4$ and $(NH_4)_2BeF_4$ has been studied in detail under various experimental conditions, with particular reference to the ferroelectric transitions in these crystals. The curves of dielectric constant vs temperature do not obey the Curie-Weiss law. The shift of the transition temperature as reported in the literature could not be detected even under extreme experimental conditions. The transition energy and entropy change have been evaluated from C_p vs T curve. The variation of the lattice parameters and the unit cell volumes with temperature has been measured by the X-ray method. ***S. Hoshino, K. Vedam, Y. Okaya, and R. Pepinsky.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 405-412.

3507 Transition to the Ferroelectric State in Barium Titanate. The phase transition in $BaTiO_3$ at the Curie point was investigated on single crystals with optical and electrical techniques. Besides raising the cubic-tetragonal transition about 15 C in the usual way with an electric field along the cube-edge direction, an orthorhombic phase was induced above the Curie point by a field along a face-diagonal direction. ***D. Meyerhofer.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 413-423.

3508 Optical Absorption and Photoconductivity in Magnesium Oxide Crystals. The effects of ultraviolet and X-ray irradiation are described, and the results are interpreted in terms of valence changes of impurities, principally iron. ***W. T. Peria.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 423-433.

3509 Molecular Theory of the Dielectric Constant. A theory of the static dielectric constant is developed on a quantum-mechanical basis, starting from the Lorentz microscopic field equations. By introducing the concept of "local field", a molecular version of the general theory is obtained and applied to compressed non-(di)polar gases at low densities. This leads to a virial series for the dielectric constant. It is shown that such a molecular theory is fundamentally ineffective in accounting for the observed results within the experimental accuracy. ***Laurens Jansen.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 435-444.

3510 Interaction Energy and Mobility of Li^+ Ions in Helium. The interaction energy of Li^+ and He has been calculated for a range of internuclear separations. The results are not in very good agreement with a similar calculation by Meyerott, who used the same wave functions but approximated many of the molecular integrals. Considerable uncertainty is caused by lack of knowledge of the second-order exchange energy. The results are used to calculate the mobility of Li^+ ions in He gas as a function of temperature for comparison with experiment. ***E. A. Mason, H. W. Schamp, Jr., and J. T. Vanderslice.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 445-448.

3511 Frequency Shift of the Zero-Field Hyperfine Splitting of Cs^{133} Produced by Various Buffer Gases. The pressure shift, caused by collisions with various noble gases in the zero-field ground-state hyperfine interaction of Cs^{133}, has been measured by an optical transmission, microwave saturation method. A pressure shift to higher frequency was found in the case of the lighter gases, hydrogen, helium, nitrogen, and neon (+1900, +1600, +930, +650 cps/mm Hg) while a pressure shift to lower frequency was found in the case of the heavier gases, argon, krypton, and xenon (−250, −1300, −2400 cps/mm Hg). ***M. Arditi and T. R. Carver.*** *Physical Review*, v. 112, ser. 2, no. 2, Oct. 15, 1958, p. 449-451.

3512 The Collective Treatment of a Fermi Gas. I. The collective approach to a Fermi gas is discussed by considering the wave functions of non-interacting Fermi gases in one and three dimensions, and of the interacting Fermi gas. It is shown how to write the one-dimensional case exactly in terms of collective coordinates, and how these have a well defined existence for long wavelengths even without interaction. This is extended as far as possible to three dimensions, and it is shown how the statistics affect the collective motion in the presence of interaction. A brief discussion is given of how calculations may be performed when redundant sets of coordinates are used. ***S. F. Edwards.*** *Physical Society, Proceedings*, v. 72, Nov. 1958, p. 685-693.

3513 Charge Transfer of Protons in Excited Atomic Hydrogen. Resonance charge transfer cross sections are calculated for protons in atomic hydrogen in the ground and first two excited states. The cross sections for an excited atom are nearly an order of magnitude larger than those for the ground state. ***T. J. M. Boyd and A. Dalgarno.*** *Physical Society, Proceedings*, v. 72, Nov. 1958, p. 694-700.

3514 Absorption of Sound in Sediments of Small Particles in Liquids. The absorption of sound in sediments of particles in different liquids is investigated as the particle size is varied. A pulse method is used at a constant frequency of 1 Mc/s. The sediments consist of small glass spheres of uniform size, eight different particle sizes in the range from 0.0035 cm to 0.016 cm radius being used in each liquid. The liquids used are water, carbon tetrachloride, benzene, and castor oil. ***K. Barron and L. E. Lawley.*** *Physical Society, Proceedings*, v. 72, Dec. 1958, p. 933-939.

3515 The Narrowing of Nuclear Magnetic Resonance Spectra by Molecular Rotation in Solids. Molecular rotation in a solid causes a narrowing of the spectrum and a consequent reduction of its second moment. It is shown that the rotation also produces weak side-spectra, which are usually unobservable. If these side-spectra are included the second moment of the entire spectrum is the same as that for the rigid solid, thus preserving the invariance of the second moment. ***E. R. Andrew and R. A. Newing.*** *Physical Society, Proceedings*, v. 72, Dec. 1958, p. 959-972.

3516 Electromagnetic Scattering by Thin Conducting Plates at Glancing Incidence. The signal scattered back from rectangular and triangular plates illuminated edge-on in an electromagnetic field is found to be large when the incident magnetic vector is normal to the plates. Explanations are sought in terms of edge diffraction, and experimental measurements indicate that the currents in the plates are predominant near to edges. The extension of rigorous theoretical results on infinite edges to the derivation of currents in finite edges is discussed; and it is shown what type of modification appears necessary to account for the experimental observations. ***J. S. Hey and T. B. A. Senior.*** *Physical Society, Proceedings*, v. 72, Dec. 1958, p. 981-995.

3517 The Measurement of Surface Recombination Velocity on Silicon. The determination of the surface recombination velocity on a silicon filament by measurement of the spectral distribution of the photoconductivity is described. Results are presented indicating surface recombination velocities on etched surfaces of less than 75 cm sec^{-1} in dry oxygen, and greater than 7500 cm. sec^{-1} in wet nitrogen. The measurements indicate that the surface recombination velocity may be a function of the carrier concentration at the surface. ***A. H. Benny and F. D. Morten.*** *Physical Society, Proceedings*, v. 72, Dec. 1958, p. 1007-1012.

3518 The Wave Mechanical Damped Harmonic Oscillator. The classical problem of a damped harmonic motion is formulated wave mechanically, with particular reference to the charge in a tuned circuit, and the electromagnetic field in a resonant cavity. Results in close agreement with the classical problem are obtained, without using perturbation theory. The classical frequency appears in the time dependence of the eigenfunctions and the classical damping appears as a decay in the eigenvalues. ***K. W. H. Stevens.*** *Physical Society, Proceedings*, v. 72, Dec. 1958, p. 1027-1036.

3519 Properties of the Metastable Helium Atoms. The available theoretical values of the oscillator strengths of dipole transitions from each of the metastable states of helium are modified so that each set satisfies four different sum rules. They are then employed to evaluate the polarizabilities, the diamagnetic susceptibilities, the average energy losses for fast particle impact, the Lamb shift average excitation energies, and the van der Waals interactions between normal and metastable helium atoms. ***A. Dalgarno and A. E. Kingston.*** *Physical Society, Proceedings*, v. 72, Dec. 1958, p. 1053-1060.

3520 Secondary Ionization Processes in Hydrogen at High Gas Pressures. Describes accurate experimental measurements of the spatial growth of ionization in steady state conditions in hydrogen at high pressures (100 to 450 mm. Hg). ***D. K. Davies, J. Dutton, and F. Llewellyn Jones.*** *Physical Society, Proceedings*, v. 72, Dec. 1958, p. 1061-1073.

3521* On the Theory of the Brownian Motion. The Brownian motion of an oscillator in a thermostat is considered assuming simple forms of interaction between them. No further assumption is made except that the thermostat is always in thermal equilibrium in itself. Solving the Liouville equation or its counterpart in quantum mechanics the long time evolution of the system is clarified. ***Morikazu Toda.*** *Physical Society of Japan, Journal*, v. 13, Nov. 1958, p. 1266-1280.

3522* Excess Noise in Narrow Germanium *p-n* Junctions. Excess noise has been studied on narrow alloyed *p-n* junctions fabricated on heavily doped *p*-type and *n*-type germanium with less than 200 Å junction width, which exhibit inverted rectification and negative resistance in the forward direction. Considerable $1/f$ noise has been observed in a forward range, the character of which is stable and surface insensitive. Moreover, the noise was found to be mainly associated with the excess forward current that is peculiar to narrow *p-n* junctions. ***Tatsuo Yajima.*** *Physical Society of Japan, Journal*, v. 13, Nov. 1958, p. 1281-1287.

3523* A Theory of Impurity Conduction. II. The impurity band conduction was treated where the resonance energy (or the translational energy) is much smaller than the fluctuation of local potential energy. By the interaction with phonon, electron can hop from one localized state to another, exchanging the difference of the local potential energies for a phonon. The agreement between theoretical and experimental results is fairly satisfactory. ***Tadao Kasuya and Sigenao Koide.*** *Physical Society of Japan, Journal*, v. 13, Nov. 1958, p. 1287-1297.

3524* Magnetic Property and Crystal Chemistry of Ilmenite ($MeTiO_3$) and Hematite (αFe_2O_3) System. II. Magnetic Property. Magnetic properties of synthesized solid solutions of ilmenite ($MgTiO_3$, $MnTiO_3$, $FeTiO_3$, $CoTiO_3$ and $NiTiO_3$) and hematite (αFe_2O_3) are investigated and it was confirmed that those of any ilmenite-hematite series can be divided into three parts: (1) pure ilmenite, (2) solid solutions with $R\bar{3}$ crystal symmetry, and (3) those with $R\bar{3}c$ crystal symmetry. ***Yoshikazu Ishikawa and Syun-iti Akimoto.*** *Physical Society of Japan, Journal*, v. 13, Nov. 1958, p. 1298-1310.

3525* The Temperature Dependence of Forced Magnetostriction. The forced magnetostriction above technical saturation was measured on some ferromagnetic materials at various temperatures, from the boiling point of oxygen to about 250 C. As expected theoretically, large forced magnetostrictions were observed either as the temperature approached up to the Curie point, or in the sample which has a considerable anomaly of thermal dilatation, such as alloys of invar system. ***Toshiro Tsuji.*** *Physical Society of Japan, Journal*, v. 13, Nov. 1958, p. 1310-1316.

3526* Spin Quenching and Magnetic Resonance. The effect of the magnetic ions of those paramagnetic salts whose spin degeneracy is completely lifted by the combined action of the spin-orbit coupling and the crystalline electric field, on the magnetic resonance of nuclear spins and electronic spins of other kinds of ions such as Cu^{2+}, Co^{2+}, Mn^{2+} substituted for the host ions are studied theoretically. ***Tôru Moriya and Yukio Obata.*** *Physical Society of Japan, Journal*, v. 13, Nov. 1958, p. 1333-1344.

3527* Nuclear Magnetic Resonance of Transition Elements in Paramagnetic Salts. Nuclear magnetic resonance of transition elements in paramagnetic salts under two situations is studied theoretically. One is the case where the magnetic ions have no Kramers degeneracy and their spin degeneracy is completely lifted by the combined action of the spin-orbit coupling and the crystalline electric field. Another is the case of the ideal paramagnetic substances under a strong magnetic field and at low temperatures. ***Tôru Moriya.*** *Physical Society of Japan, Journal*, v. 13, Nov. 1958, p. 1344-1352.

3528* Electroluminescence of Insulated Particles. The origin of the local high electric field in the electroluminescence of insulated phosphor particles is considered and attributed to the disturbance of the applied field due to the conductive substance in the insulative phosphor. The distributions of local field are calculated and the dependence of brightness on the applied voltage is discussed. However, the comparison with experiments is impossible because of the complicated structure of the phosphor. Finally, the luminous efficiency of electroluminescent cell is estimated and an agreement is obtained with the observed value. ***Keiji Maeda.*** *Physical Society of Japan, Journal*, v. 13, Nov. 1958, p. 1352-1361.

3529* Attenuation of Ultrasonic Waves in Suspensions of Viscoelastic Spheres. The attenuation of ultrasonic waves for suspensions of polymethyl methacrylate particles (mean radius a = ca. 40μ) in ethyl alcohol, carbon tetrachloride and their mixtures are measured in the range of frequency 1-6 Mc/s. ***Yasaku Wada.*** *Physical Society of Japan, Journal*, v. 13, Nov. 1958, p. 1390-1398.

3530* Quantum Statistical Mechanics of Electron-Phonon System. II. Specific Heat and Spin Paramagnetic Susceptibility. The effect of the electron-phonon interaction on specific heat and spin paramagnetic susceptibility of conduction electrons in metals are investigated using the method proposed by the author in the previous paper. Calculations up to terms of the second order of the interaction Hamiltonian show that specific heat is increased and spin paramagnetic susceptibility is decreased by the presence of the electron-phonon interaction, and the effect is much larger in the former than in the latter. ***Hiroshi Ichimura.*** *Progress of Theoretical Physics*, v. 20, no. 4, Oct. 1958, p. 415-438.

3531* On the Wave Propagation in the Non-Linear Fields. II. The general scalar non-linear fields satisfying the Lorentz-covariance are classified into two groups, the semi-linear and the quasi-linear. The singularities on wave fronts are investigated in each case, on the basis of the characteristic theory of partial differential equations. ***Toshiya Taniuti.*** *Progress of Theoretical Physics*, v. 20, no. 4, Oct. 1958, p. 529-541.

3532* Indirect Coupling of Nuclear Spins in Antiferromagnet With Particular Reference to MnF_2 at Very Low Temperatures. Indirect coupling of nuclear spins through hyperfine interaction with spin waves is discussed in the case of antiferromagnet at very low temperatures. The line width of the F^{19} nuclear magnetic resonance in MnF_2 at 1.4 K observed by Shulman and Jaccarino (14 oe) proves to come mainly from this coupling. The line width of the Mn^{55} resonance in MnF_2 is also evaluated to be about 600 oe. ***Tuto Nakamura.*** *Progress of Theoretical Physics*, v. 20, no. 4, Oct. 1958, p. 542-552.

3533* Quasi-Chemical Equilibrium Theory. II. The quasi-chemical equilibrium, or pair correlation, approximation to statistical mechanics is written in terms of second-quantization formalism. This involves an extension of the original theory to include an Ansatz for off-diagonal elements of the density matrix. ***J. M. Blatt and Takeo Matsubara.*** *Progress of Theoretical Physics*, v. 20, no. 4, Oct. 1958, p. 553-575.

3534 The Behaviour of the Paramagnetic Ions in the Single Crystals of Some Similarly Constituted Salts of the Iron Group of Elements. II. Hydrated Ni^{2+} Salts. The magnetic anisotropy behavior of 17 similarly constituted hydrated Ni^{2+} salts has been studied. ***A. Bose, S. C. Mitra, and Sunil K. Datta.*** *Royal Society, Proceedings*, v. 248, ser. A, Nov. 11, 1958, p. 153-168.

3535 An Optical Method of Studying the Diffraction From Imperfect Crystals. III. Layer Structures With Stacking Faults. The reciprocal lattice intensity distribution has been determined quantitatively using a photomultiplier to measure the optical diffraction intensities. ***B. T. M. Willis.*** *Royal Society, Proceedings*, v. 248, ser. A, Nov. 11, 1958, p. 183-198 + 2 plates.

3536* The Polarization of Atomic Line Radiation Excited by Electron Impact. The dipole radiation emitted by an atom excited by a unidirectional electron beam has a non-uniform angular distribution which is simply related to the percentage polarization of the radiation emitted perpendicular to the beam. ***I. C. Percival and M. J. Seaton.*** *Royal Society of London, Philosophical Transactions*, v. 251, Ser. A. Mathematical and Physical Sciences, no. 990, Nov. 6, 1958, p. 113-138.

3537 The Solid State for Engineers. Objective is to acquaint engineers and engineering students with the basic principles which underlie the behavior of the solid materials that they use on the basis that the subject of engineering materials is one of

the common links in all branches of engineering and as such is similar to physics, mathematics, and chemistry. ***Maurice J. Sinnott.*** 522 pp. 1958. John Wiley and Sons, New York. (QC21 Si66s)

3538* Investigations of the Exoelectron Emission and Luminescence of Inorganic Crystals. Dying out of exoelectron emission as function of time and at different temperatures. Effect of ion bombardment and regeneration on the capacity of electron emission. Glow curves of the electron emission and the luminescence of a natural CaF_2 crystal before and after X-radiation. Detection of low-emission by means of heat stimulating electron emission. (*In German.*) Untersuchungen der Exoelektronenemission und Lumineszenz anorganischer Kristalle. ***G. Gourgé.*** *Zeitschrift für Physik*, v. 153, no. 2, 1958, p. 186-206.

3539* Field Emission From Stimulated Farnsworth Centers. The optical stimulation of a F-center at low temperatures leads to a latent stimulated state of the F-electron, resulting generally in a radiating inverse process in the ground state. Zener effect when high electric fields are applied. Direct observation of the process on F-centers during the extinction of fluorescence and by absorption measurement. (*In German.*) Feldemission aus angeregten Farbzentren. ***Fritz Lüty.*** *Zeitschrift für Physik*, v. 153, no. 2, 1958, p. 247-256.

3540 Non-Linear Electron Oscillations in a Cold Plasma. Investigations of non-linear electron oscillations in a cold plasma where the thermal motions may be neglected indicate that except for the simplest one-dimensional situation such oscillations will destroy themselves through the development of multi stream flow. ***John M. Dawson.*** *U. S. Atomic Energy Commission*, NYO-8050, Aug. 1, 1958, 20 pp. (UF767 U3ny Contin.)

3541* Functional Relationship of Temperature of the Spectral Photoelectric Electron Emission of Semiconducting Bismuth Films. Measurement of the spectral photoelectric sensitiveness of thin films, vaporized in vacuum, of pure Bi and of Bi doped with Te, in the ordered and disordered states. Effect on the amplitude of the splitting of the Fowler curve into two Fowler functions. (*In German.*) Über die Temperaturabhängigkeit der spektralen lichtelektrischen Elektronenemission halbleitender Wismutfilme. ***R. Suhrmann, G. Wedler, and E. A. Dierk.*** *Zeitschrift für Physik*, v. 153, no. 1, 1958, p. 96-105.

3542* Investigation of the Spectral Distribution of Photoconductivity in CdS Single Crystals at 20 and 77 K. Method of measurement and experimental results obtained in investigation of spectral dependence of photocurrent and proper time of photocarriers, and of the connection of these magnitudes with absorption coefficient of light of various wave length. (*In Russian.*) Issledovanie spektral'nogo raspredeleniia fotoprovodimosti monokristallov CdS pri 77 i 20° k. ***V. L. Broude, V. V. Eremenko, and M. K. Sheinkman.*** *Zhurnal Tekhnicheskoi Fiziki*, v. 28, no. 10, Oct. 1958, p. 2142-2151.

3543* Dielectric Polarization and Piezoelectric Properties of Ferroelectric Solid Solutions of Calcium, Strontium and Barium Metaniobates in Lead Metaniobate. Preparation of specimens, method of measurements and consideration of the results. Study of the effect of calcium metaniobate contents on the Curie point of solid solutions of calcium metaniobate in lead metaniobate. (*In Russian.*) Dielektricheskaia poliarizatsiia i p'ezoelektricheskie svoistva segnetoclektricheskikh tverdykh rastvorov metaniobatov kal'tsiia, strontsiia i bariia v metaniobate svintsa. ***V. A. Isupov and V. I. Kosiakov.*** *Zhurnal Tekhnicheskoi Fiziki*, v. 28, no. 10, Oct. 1958, p. 2175-2185.

3544* Absorption of Gases in a Low Pressure Arc. A detailed study of (1) conditions of absorption of some gases during arc discharge, (2) stability of absorption in relation to discharge current, and (3) role of individual elements of a Hg rectifier in gas absorption. Method of investigation and equipment. (*In Russian.*) Pogloshchenie gazov v duge nizkogo davleniia. ***E. Ia. Pumper.*** *Zhurnal Tekhnicheskoi Fiziki*, v. 28, no. 10, Oct. 1958, p. 2275-2281.

3545* Thermoelectric Properties of Some Metal-Like Compounds. Investigation of thermoelectric properties of a series of carbides, nitrides, borides, and silicides of transitional metals at 300 to 1400 K. All investigated borides have thermoelectric properties typical of metals with a certain amount of impurities dissolved in them. The nitrides and silicides show different properties. This is indicated by a non-linear change of thermo-emf and by significant non-linearity of specific resistance with change of temperature. Such non-linearity (and in case of $FeSi_2$ and TaN even a drop of the specific resistance) with temperature increase can be explained either by structural changes or by the change of the character of conductivity. (*In Russian.*) Termoelektricheskie svoĭstva nekotorykh metallopodobnykh soedineniĭ. ***N. V. Kolomoets, V. S. Neshpor, G. V. Samsonov, and S. A. Semenkoviche.*** *Zhurnal Tekhnicheskoĭ Fiziki*, v. 28, no. 11, Nov. 1958, p. 2382-2389.

See also: **2817** (advances in electrophysics); **2877** (space charge waves and slow electromagnetic waves); **3283** (characteristics of InP).

PLASTICS

3546* Telomerization of Ethylene With Tetrachloroethylene. Telomerization in this case was used to synthesize tetrachloroalkenes capable of reaction and containing an even number of C atoms in the molecule. The following were obtained: 1,1,2,4-tetrachlorobutene-1; 1,1,2,6-tetrachlorohexene-1; and 1,1,2,8-tetrachlorooctene (*In Russian.*) Telomerizatsiia etilena s tetrakhloretilenom. ***A. N. Nesmeianov, R. Kh. Freidlina, and A. B. Beliavskiĭ.*** *Akademiia Nauk SSSR, Doklady*, v. 122, no. 5, Oct. 11, 1958, p. 821-824.

3547* Investigation of Electron-Paramagnetic Resonance Spectra of Some Polymers Irradiated at 77 K. Investigation of free radicals formed during irradiation of a series of polymers and materials with polymer base at 77 K by means of the electron-paramagnetic resonance method. Investigation of polyethylene, polyvinylchloride, teflon, polydimethylsiloxene, polyisobutylene, polymethylmethacrylate, polystyrene, polybutylmethacrylate, and natural rubber. (*In Russian.*) Issledovanie spektrov e.p.r. nekotorykh polimerov obluchennykh pri 77 K. ***Iu. D. Tsvetkov, N. N. Bubnov, M. A. Makul'skiĭ, Iu. S. Lazurkin, and V. V. Voevodskiĭ.*** *Akademiia Nauk SSSR, Doklady*, v. 122, no. 6, Oct. 21, 1958, p. 1053-1056.

3548* Aspects of the Radiation Vulcanization of Polyamides. Experimental evidence of simultaneous occurrence of destruction and formation reactions in polyamides under actions of ionizing radiation. As the object of the investigation, the soluble mixed polyamide "anid G-669" was selected, which is a product of polycondensation of hexamethylenediamine, adipic and azelaic acids, and caprolactom. (*In Russian.*) O zakonomernostiakh radiatsionnoĭ vulkanizatsii poliamidov. ***S. A. Pavlova, S. R. Rafikov, and B. L. Tsetlin.*** *Akademiia Nauk SSSR, Doklady*, v. 123, no. 1, Nov.-Dec. 1958, p. 127-130.

3549* Thermal Polymerization of Dimethylbutenes at High Pressure. Detailed investigation of thermal polymerization of 2,3-dimethylbutene-2 at pressure around 4000 kg/cm² and temperature 290 C. Also study of polymerization of 2,3-dimethylbutene-1 and 3,3-dimethylbutene-1 under the same conditions. (*In Russian.*) Termicheskaia polimerizatsiia dimetilbutenov pri vysokikh davleniiakh. ***M. G. Gonikberg and V. M. Zhulin.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1958, no. 10, Oct., p. 1254-1263.

3550 Dead-End Radical Polymerization. When radical initiators are used to initiate the polymerization of vinyl monomers, and if there is no retardation of termination at high conversions, the polymerization ceases short of complete conversion. In certain cases the limiting conversion may be very low. A complete theoretical treatment is given for the case of initiation with 2-azobisisobutyronitrile. The results are worked out in detail for this initiator in styrene at 100 C. ***Arthur V. Tobolsky.*** *American Chemical Society, Journal*, v. 80, Nov. 20, 1958, p. 5927-5929.

3551 The Polymer Chemistry of Coating Compositions. IV. Plasticization and Copolymerization. Includes the control of the internal and spatial arrangement of atoms in polymers and the use of stereospecific catalysts. ***Murray B. Hundert.*** *American Paint Journal*, v. 43, Dec. 15, 1958, p. 98 + 11 pages.

3552 Polystyrene Lined Shuttering for Concrete. Sheeting is used as a form liner. *British Plastics*, v. 31, Nov. 1958, p. 467.

3553 Cellulose Propionate. Properties and applications. ***W. D. Paist and D. A. Jones.*** *British Plastics*, v. 31, Nov. 1958, p. 474-476.

3554 Factors Affecting the Tensile Strength of Phenolic Mouldings. Factors investigated were preform shape, air gap between upper electrode and surface of preform, curing time, period of preheating, and total heat input. ***F. R. Smith and J. A. Laird.*** *British Plastics*, v. 31, Nov. 1958, p. 477-481.

3555 Nylon 6 for Process Applications: Tougher, Stronger Than Usual Nylons. Nylon 6 is polymerized from caprolactam. Advantages include light weight, high strength, resistance to elevated temperatures, wear resistance, good chemical resistance, plus exceptional ease of processing. ***D. L. Duncan.*** *Chemical Engineering*, v. 65, Dec. 1, 1958, p. 130 + 2 pages.

3556 Allyl Polymerizations. General polymerization theory, initiation of allyl polymerizations, inhibition and acceleration, kinetics, determination of residual unsaturation in the polymers, prediction of polymerizability, gelation, chain transfer, copolymerization theory, phosphorus polymers and copolymers used in flameproofing, future of allyl polymers. ***R. C. Laible.*** *Chemical Reviews*, v. 58, no. 5, Oct. 1958, p. 807-843.

3557* Studies on Polymerization and Depolymerization of ε-Caprolactam Polymer. V. On the Reaction Mechanism of the Catalytic Polymerization of ε-Caprolactam by Alkali Metal. VI. On the Reaction Mechanism of the ε-Caprolactam Polymerization by Alkali Metal Compound. ***Hirosuke Yumoto and Naoya Ogata.*** *Chemical Society of Japan, Bulletin*, v. 31, no. 8, Nov. 1958, p. 907-917.

3558* Chlorofluorinated Polymers and Their Derivatives. II. Manufacture and Applications. (*In French.*) Les polymères chlorofluorés et leurs dérivés. II. Mise en oeuvre et applications. ***M. Flamant.*** *Chimie & Industrie*, v. 80, no. 5, Nov. 1958, p. 579-586.

3559 Special Report on 'Lexan'. A new polycarbonate resin, based on phenols reacted with ketones, is used primarily as a molding material. The most important properties are high impact strength, good dimensional stability, heat resistance, and good electrical properties. *Design News*, v. 13, Nov 24, 1958, p. 16-17.

3560 Dielectric Properties of Reinforced Plastics at Elevated Temperatures. A discussion of basic resins, reinforcements, and fabrication techniques and their effect on the behavior of reinforced plastics materials, especially laminates, under elevated temperature conditions, with emphasis on dielectric properties. ***Irving Katz and J. Goldberg.*** *Electrical Manufacturing*, v. 62, Dec. 1958, p. 72-78.

3561 Cohesive Energy Densities of Polymers. I. Cohesive Energy Densities of Rubbers by Swelling Measurements. II. Cohesive Energy Densities From Viscosity Measurements. Swelling measurements have been made on vulcanized natural rubber and eight synthetic rubbers in a wide range of solvents, and values for X (or μ), the interaction parameter, derived by application of the Flory-Rehner theory. From an analysis of these values, cohesive energy densities have been assigned to the rubbers. Values are deduced for the interaction parameter X for polymethyl methacrylate, polystyrene, and polyvinyl chloride systems by an application of the Fox-Flory theory to the viscosities of a polymer fraction in a suitable range of solvents. Analysis of these values leads to the assignment of cohesive energy densities for the polymers. For natural and butyl rubbers it is shown that the analysis of viscosity and swelling measurements lead to identical values of cohesive energy density. ***G. M. Bristow and W. F. Watson.*** *Faraday Society, Transactions*, v. 54, Nov. 1958, p. 1731-1747.

3562 Stereospecific Polymerizations by Means of Coordinated Anionic Catalysis. The phenomena stereoisomerism in the linear polymers of olefines and diolefines and the nature of the stereospecific polymerization processes are discussed. They allowed the first synthesis of isotactic and syndiotactic polymers, and of the four pure stereoisomers of polybutadiene. The structure of catalytic complexes that promote the stereospecific polymerization in the ionic coordinated catalysis is pointed out. ***Giulio Natta.*** *Journal of Inorganic and Nuclear Chemistry*, v. 8, 1958, p. 499-611.

3563* Effect of Physical State During the Electron Irradiation of Hydrocarbon Polymers. I. The Influence of Physical State on Reactions Occurring in Polyethylene During and Following the Irradiation. II. Additional Experiments and Discussion Pertaining to Trapped Radicals in Hydrocarbon Polymers. ***Elliott J. Lawton, J. S. Balwit, and R. S. Powell.*** *Journal of Polymer Science*, v. 32, Nov. 1958, p. 257-290.

3564* Dynamic Mechanical Properties of Polyethylene Terephthalate. Dynamic mechanical properties have been measured as function of temperature at −70 to +310 C at 100-200 cycles/sec. by a cantilever vibration method. ***T. Kawaguchi.*** *Journal of Polymer Science*, v. 32, Nov. 1958, p. 417-424.

3565* A Thermistor Method of Determining the Rate Constant for the Copolymerization of Vinyl Acetate and Methyl Methacrylate. Measurement of the over-all rate for the copolymerization at various monomer ratios and by use of a thermistor method to obtain the absolute rate of "crossed" chain termination. ***M. Suzuki, H. Miyama, and S. Fujimoto.*** *Journal of Polymer Science*, v. 32, Nov. 1958, p. 445-455.

3566* Mechanical Relaxation Phenomena in Polytetrafluoroethylene. Investigation of the relaxation behavior of Teflon in a temperature range from −150 to +200 C. An attempt to establish a relationship of various absorption regions with the molecular mechanism. (*In German.*) Mechanische Relaxationserscheinungen in Polytetrafluoräthylen. ***K. H. Illers and E. Jenckel.*** *Kolloid-Zeitschrift*, v. 160, no. 2, Oct. 1958, p. 97-106.

3567* Dependence of Temperature Maxima of Loss Angles of Softened Polyvinylchloride Mixtures on Dipole Moment and Concentration of Plasticizer. Experimental determination of the dependence using a quantitative investigation of the relationships considering dipole moments of plasticizers as characteristic magnitudes. Subsequently an attempt is made to give the supposed mathematic relation of measuring values a theoretical explanation. The theory is based on statistical mechanics and thermodynamics. (*In German.*) Über die Abhängigkeit der Temperaturmaxima des Verlustwinkels weichgemachter Polyvinylchloridmischungen von Dipolmoment und Konzentration der Weichmacher. ***Günther Zaeschmar.*** *Kolloid-Zeitschrift*, v. 160, no. 2, Oct. 1958, p. 107-114.

3568 A New Look at Nylon Plastics. Properties of various grades of nylon are compared with other high-impact thermoplastics. ***Malcolm W. Riley.*** *Materials in Design Engineering*, v. 48, Dec. 1958, p. 94-99.

3569 WVTR of Oriented Polystyrene. A study of water-vapor transmission rates over a wide range of thickness points to greater efficiency of film and sheet in thinner gauges. ***Howard A. Scopp and Albert Adakonis.*** *Modern Packaging*, v. 32, no. 4, Dec. 1958, p. 123 + 1 page.

3570 Polypropylene Film. Packaging properties of a new member of the polyolefin family, comparing its qualities with those of the polyethylenes. ***Bruce M. Miller.*** *Modern Packaging*, v. 32, no. 5, Jan. 1959, p. 113-116.

3571 Quick Survey of New Resins. ***J. Harry DuBois.*** *Modern Plastics*, v. 36, no. 4, Dec. 1958, p. 103 + 5 pages.

3572 Surface Erosion of Filled Plastics. Reinforced plastics were exposed to 50 cycles of washing with a hot detergent solution, rinsing, and drying. The materials studied included glass-fabric laminates prepared with polyester, diallyl phthalate, phenolic, and epoxy resins, and panels molded from phenolic and melamine molding compounds containing both organic and inorganic bulk fillers. ***S. B. Newman, S. D. Toner, and B. G. Achhammer.*** *Modern Plastics*, v. 36, no. 4, Dec. 1958, p. 135 + 11 pages.

3573* Diffusion Processes in Polymers Under Irradiation; Polyvinyl Alcohol and CCl_4 System. ***Tsutomu Watanabe.*** *Physical Society of Japan, Journal*, v. 13, Nov. 1958, p. 1316-1324.

3574* The Study of the Transition Phenomena of Chain Polymers by the Photoelastic Method. The glass transition phenomena of chain polymers can be studied by observing the temperature dependency of the photoelasticity of the materials;

the transition temperature determined using this method agrees with the second order transition point by the specific volume method for PVC, but for polystyrene it is a little higher and rather near to the softening point by the dynamical elastic method. ***Motozo Kaneko.*** *Physical Society of Japan, Journal*, v. 13, Nov. 1958, p. 1324-1327.

3575* Chippewa Plastics Opens Unique New Plant for Polyethylene Film. A new $500,000 plant, with two of its three stories buried below ground for the most efficient production of film. *Plastics Industry*, v. 16, Dec. 1958, p. 32-33.

3576* A Unique One-Piece Molding. Problems in the development of a unique, one piece molding of a reinforced plastic helicopter controvane. ***Kurt A. Schneider.*** *Plastics Industry*, v. 16, Dec. 1958, p. 34-37.

3577 Polyurethane Synthetic Rubber. History, chemistry, properties, special grades, and applications. *Plastics (London)*, v. 23, Dec. 1958, p. 458-460.

3578 Cellulose Propionate. II. Uses and Applications. ***D. A. Jones.*** *Plastics (London)*, v. 23, Dec. 1958, p. 462-464.

3579* Heat Resistant Phenolic Laminates. Plastics materials for high temperature applications are used in aircraft, space vehicles, and for other industrial purposes. Behavior of thermo-setting resins up to 3000 F is described. ***A. H. Haroldson.*** *Rubber and Plastics Age*, v. 39, Nov. 1958, p. 961 + 2 pages.

3580 Polyurethane Foams. Versatility of Process and Applications. Uses, production, and properties are discussed. ***J. M. Buist.*** *Rubber Journal and International Plastics*, v. 135, no. 21, Nov. 22, 1958, p. 792-799.

3581 Rigid Urethane Foams Based on Sorbitol Derivatives. Certain hydroxyl-terminated polyethers can be used satisfactorily as a major component of rigid urethane foams. These polyethers are hexafunctional materials prepared by reacting propylene oxide with sorbitol. ***Joseph E. Wilson and Raymond H. Fowler.*** *Science*, v. 128, Nov. 28, 1958, p. 1343.

3582* Polymerization of Isoprene With Styrene. Calculation of copolymerization constants based on determination of the composition of isoprene-styrene polymers. In polymerization of condensed phase the constants are: $\alpha = 2.02$ and $\beta = 0.42$; in emulsion polymerization: $\alpha = 1.98$ and $\beta = 0.44$. Physicomechanical properties of isoprene-styrene polymers and their vulcanized rubbers. (*In Russian.*) Polimerizatsiia izoprena so stirolom. ***M. P. Zverev and M. F. Margaritova.*** *Ukrainskii Khimicheskii Zhurnal*, v. 24, no. 5, 1958, p. 626-628.

3583* Internal Rotation in Polymer Chains and Their Physical Properties. XI. Stretching of Rotational-Isomer and Free-Connected Polymer Chains. Calculation of the relationship between mean length of polymer chain and the force affecting the length for several models of two-dimensional rotational-isomer chains. Consideration of the role of various mechanisms of chain stretching. (*In Russian.*) Vnutrennee vrashchenie v polimernykh tsepiakh i ikh fizicheskie svoĭstva. XI. Rastiazhenie povorotno-izomernykh i svobodno sochlenennykh polimernykh tsepeĭ. ***T. M. Birshtein.*** *Zhurnal Tekhnicheskoĭ Fiziki*, v. 28, no. 11, Nov. 1958, p. 2493-2501.

See also: **2768** (flame spraying and sintering of plastics); **2778** (polyurethane resins and deepoxidized spray resins); **2996** (polymer melting point determination); **3028** (plastics for photothermoelastic stress analysis).

POLLUTION AND WASTES

3584 Plant-Type Polarographic System for Determining Uranium in Radioactive Waste Streams. . . . is designed for in-line use and records the uranium concentration in the range from 10^{-4} to 10^{-2} M every 7½ minutes. The instrument has been used for nearly a year in pilot plant operation and is considered suitable for use in highly radioactive streams in processing plants. ***G. J. Alkire, Karl Koyama, K. J. Hahn, and C. E. Michelson.*** *Analytical Chemistry*, v. 30, Dec. 1958, p. 1912-1915.

3585 A Fractional Sublimation Technique for Separating Atmospheric Pollutants. A new possibility for separating relatively large quantities of the particulate organic material found in polluted atmospheres. A method has been developed using a mixture of condensed polynuclear aromatic hydrocarbons of known composition. ***Jerome F. Thomas, Eldon N. Sanborn, Mitsugi Mukai, and Bernard D. Tebbens.*** *Analytical Chemistry*, v. 30, Dec. 1958, p. 1954-1958.

3586* The Atmospheric Pollution of Cities. Assesses the pollution levels of sulphur dioxide (and smoke) likely to be produced by thousands of domestic fires in large British cities. Shows that the major part of the pollution measured can be attributed to domestic fires even though the concentrations produced by a single fire are negligible. ***D. H. Lucas.*** *International Journal of Air Pollution*, v. 1, nos. 1/2, Oct. 1958, p. 71-86.

See also: **2600** (acetylene in air).

RUBBER AND ELASTOMERS

3587* Friction of Rubber. Reasons for using rubber in structural elements and power transmission. Frictional properties. Skidding at low speeds. The use of belts and disks. Transmission of traction and brake pressure through tires. Cornering. Friction laws. Comparison between rubber and metal friction. (*In German.*) Reibung von Gummi. ***Eric Gough.*** *Kautschuk und Gummi*, v. 11, Nov. 1958, p. WT303-WT312.

3588 Elastomers for High Temperature Applications. A review of the source and nature of high-temperature elastomer problems; limitations of the more conventional elastomer materials are discussed. Recent data on properties of special high-temperature polymers and their compounds are included. ***E. R. Bartholomew.*** *North Atlantic Treaty Organization, AGARD Report No.* 178, Mar.-Apr. 1958, 23 pp. (TL565 Ag11r Vis.)

3589* Corrosion Control With Neoprene and "Hypalon" Synthetic Rubber. Properly compounded coatings of neoprene and "Hypalon" have proven particularly effective in the battle against corrosion. *Paint Industry Magazine*, v. 73, Nov. 1958, p. 14 + 3 pages.

3590 Phenolic Resins in Rubber Compositions. ***E. G. Curphey.*** *Plastics (London)*, v. 23, Dec. 1958, p. 465-466.

3591* The Colloid Phase Carbon Reinforcement of Rubber. By recognizing the time factor in colloidal reactions, a significant improvement in the carbon reinforcement of rubber has been effected. ***H. A. Braendle, G. L. Heller, and J. W. White.*** *Rubber Age*, v. 84, no. 3, Dec. 1958, p. 431-439.

3592* Ozone Resistance of Butyl Rubber. An attempt to evaluate certain variables, ozone concentration and applied stress, to elucidate the mechanism of ozone attack. ***R. F. Grossman and A. C. Bluestein.*** *Rubber Age*, v. 84, no. 3, Dec. 1958, p. 440-443.

3593* Behavior of Silicone Rubber in Sealed Systems at High Temperatures. Hardness, tensile strength, and elongation were measured. The formulation, processing, and environmental variables that affect the behavior of the rubber were defined. ***W. J. Bobear.*** *Rubber Age*, v. 84, no. 3, Dec. 1958, p. 448-450.

3594 Use of Factice in Butyl Rubber. II. Determination of Optimum Cure. ***C. Falconer Flint and J. Donnelly.*** *Rubber Journal and International Plastics*, v. 135, no. 19, Nov. 8, 1958, p. 725 + 7 pages.

3595* Combined Heat and Radiation Effects on Practical Rubber Compounds. Measuring and improving the resistance of factory-type rubber stocks to damage by nuclear radiation. ***J. W. Born, E. E. Mooney, and S. T. Semegen.*** *Rubber World*, v. 139, no. 3, Dec. 1958, p. 379 + 8 pages.

3596* Present Status of Latex Rubber Foam. Variation in physical properties of latex foam when made using 100% synthetic rubber as the polymer. ***T. H. Rogers and K. C. Hecker.*** *Rubber World*, v. 139, no. 3, Dec. 1958, p. 387-392.

See also: **3036** (bonded rubber assemblies); **3561** (cohesive energy densities of rubbers).

SPACE HEATING AND CONDITIONING

3597* Permanent Pressure Gages Spot Ventilation Troubles. Gages connected for reading at a central panel provide ready means for early spotting of any need for maintenance action. ***George M. Hama.*** *Air Conditioning, Heating, and Ventilating*, v. 55, Dec. 1958, p. 61-62.

3598* Sound Control in Air Conditioning Systems. Presents the basic formulas and data, and covers design considerations for controlling sound at various points in an air conditioning system. ***Paul B. Ostergaard.*** *Air Conditioning, Heating, and Ventilating*, v. 55, Dec. 1958, p. 71-81.

3599 Noise Control of Domestic Appliances. Environment and use are often as important as the actual magnitude and frequency of the noise. Examples are considered. ***R. Plunkett.*** *Electrical Engineering*, v. 77, Dec. 1958, p. 1106-1108.

3600* Ventilation and Extraction of Air Within the Scheme of Planning Foundries. Ventilation equipment in the hand molding shop, in the partly and fully mechanized foundry, in the core-making shop, at melting furnaces, and in the fettling room. (*In German.*) Be- und Entlüftung im Rahmen der Planung von Giessereien. ***Karl Nilsson and Yngve Borin.*** *Giesserei*, v. 45, no. 23, Nov. 6, 1958, p. 689-698.

3601* New Ways of Combating Dust and Fumes Within the Foundry. Disadvantages of the conventional removal of dust and fumes through the ceiling. Advantages of exhausting through the floor. (*In German.*) Neue Wege zur Staub- und Rauchbekämpfung in der Giesserei. ***Torsten Wrene.*** *Giesserei*, v. 45, no. 23, Nov. 6, 1958, p. 698-700.

3602 What Does Gas Air Conditioning Cost? Absorption System and Steam Turbine Driven Compressor System. Actual operating data from two gas air-conditioned industrial plants. ***H. Campbell Stuckeman.*** *Heating, Piping & Air Conditioning*, v. 30, Dec. 1958, p. 109-110.

3603* Air Conditioning the Lockheed Electra. Passengers on this aircraft will be cooled by a single air supply duct and warmed by radiant panels in the sidewalls. ***J. G. Krisilas and E. S. McCarthy.*** *SAE Journal*, v. 66, Dec. 1958, p. 58-62.

3604* Cabin Pressurization Now Needs Built-In Reliability. Outlines what reliability means for cabin pressurization design. ***Carl W. Jonasson.*** *Space/Aeronautics*, v. 31, no. 1, Jan. 1959, p. 142 + 7 pages.

See also: **2918** (fuel-oil characteristics).

TEXTILES, FIBERS, LEATHER, AND PAPER

3605 Studies on Slime Accumulations in Pulp and Paper Mills. I. Some Fungi Isolated From Mills in New Brunswick and Newfoundland. ***D. Brewer.*** *Canadian Journal of Botany*, v. 36, no. 6, Nov. 1958, p. 941-946.

3606* Synthesis of Poly-(L-prolyl-L-leucyl-glycyl.) An Attempted Synthesis of Model Collagen. The two tripeptides, L-prolyl-L-leucyl-glycine and glycyl-L-prolyl-L-leucine were synthesized, and the former was polymerized by the pyrophosphite method. ***Hidetoshi Kitaoka, Shumpei Sakakibara, and Hisaya Tani.*** *Chemical Society of Japan, Bulletin*, v. 31, no. 7, Oct. 1958, p. 802-807.

3607* Marketable Sawdust Composts. Their Preparation and Fertilizing Value. Anhydrous ammonia is added as the source of nitrogen. The mash is then neutralized with phosphoric acid, innoculated with *Coprinus ephemerus*, and aerated regularly. ***S. A. Wilde.*** *Forest Products Journal*, v. 8, Nov. 1958, p. 323-326.

3608* Chemical Composition of Cork From White Fir Bark. Consists primarily of a lignocellulosic network impregnated with a waxy ester and a complex polyphenol, both of which have potential commercial value. ***H. L. Hergert.*** *Forest Products Journal*, v. 8, Nov. 1958, p. 335-339.

3609* Seed Orchards—Their Concept and Management. ***Bruce J. Zobel, John Barber, Claud L. Brown, and Thomas O. Perry.*** *Journal of Forestry*, v. 56, Nov. 1958, p. 815-825.

3610* Vegetative Propagation in Forest Genetics Research and Practice. ***Hans Nienstaedt, Franklin C. Cech, Francois Mergen, Wang Chi-Wu, and Bratislav Zak.*** *Journal of Forestry*, v. 56, Nov. 1958, p. 826-839.

3611* Early Cone Production in Loblolly Pine. ***M. Reines and J. T. Greene.*** *Journal of Forestry*, v. 56, Nov. 1958, p. 855.

3612* The Bonding of Rigid PVC Sheet to Chipboard and Fiberboard. Discusses the finishing of chipboard and fiberboard with special reference to the various types of material which are available. (*In German.*) Die Verleimung von Hart-PVC-Platten mit Holzspanplatten und Holzfaserplatten. ***Carl Kubitzky.*** *Kunststoffe*, v. 48, Nov. 1958, p. 549-551.

3613* Experimental Map Papers Containing Synthetic Fibers Show Enhanced Strength and Dimensional Stability. Polyesters give the best dimensional stability. Paper containing polyamide fibers has excellent folding, tearing, and bursting strengths, but low dimensional stability. *Paper Trade Journal*, v. 142, Dec. 29, 1958, p. 28-29.

3614* Measurement of Sap Flow in Conifers by Heat Transport. A reinterpretation should be made of sap flow measurements made by heat transport methods. Sap flow velocity is shown not to be the same as that of the heat pulse. ***D. C. Marshall.*** *Plant Physiology*, v. 33, no. 6, Nov. 1958, p. 385-396.

3615* The Importance of Hardwoods to the Pulp and Paper Industry. ***D. W. Ambridge.*** *Pulp and Paper Magazine of Canada*, v. 59, Oct. 1958, p. 185-187.

3616* Improvement of Hardwoods Through Genetics. Three general areas of industrial interest which may be affected by pulpwood quality differences are recognized. As a concrete example chosen from one of these areas, the nature and possible justification of a genetic approach to sheet strength improvement are explored in some detail, and with reference to recent fundamental studies of pulp influence upon sheet strength. ***Philip N. Joranson.*** *Pulp and Paper Magazine of Canada*, v. 59, Oct. 1958, p. 193-201.

3617* The Morphology of Hardwood Fibres. ***Paul W. Lange.*** *Pulp and Paper Magazine of Canada*, v. 59, Oct. 1958, p. 210-216.

3618* Chemical Aspects of Hardwood Lignins. ***J. M. Pepper.*** *Pulp and Paper Magazine of Canada*, v. 59, Oct. 1958, p. 253-259.

3619* Physical and Anatomical Characteristics of Hardwoods. Explains the anatomical basis of the technological properties of wood. Variations in cell-structure of hardwoods are shown to correspond with variation in specific gravity of wood. Indicates the anatomical basis of shrinkage and swelling of wood in the submicroscopic structure of the walls of the wood fibers that determine the direction of the grain and shows also that wood normally shrinks or swells across the direction of the fibers. ***J. D. Hale.*** *Pulp and Paper Magazine of Canada*, v. 59, Dec. 1958, p. 142-150.

3620* Studies on Zirconium Tannage. The Mechanism of the Tannage. ***T. S. Ranganathan and R. Reed.*** *Society of Leather Trades' Chemists, Journal*, v. 42, Nov. 1958, p. 351-360.

3621* Studies in the Static Electrification of Filaments. Attempts to establish a working hypothesis that will permit the

separation of the dominant factors effective in static electrification of textile materials. ***R. G. Cunningham and D. J. Montgomery.*** *Textile Research Journal*, v. 28, Dec. 1958, p. 971-979.

3622* Effects of Crimp and Cross-Sectional Area on the Mechanical Properties of Wool Fibers. ***Joseph H. Dusenbury and James H. Wakelin.*** *Textile Research Journal*, v. 28, Dec. 1958, p. 989-1005.

WELDING AND JOINING

3623 The Fatigue Strength of Magnesium Alloy HK31 as Modified by a Weld Joint. The fatigue strength of the welded sheet is 40 to 45% that of the original stock, but can be raised to between 50 and 60% of the original stock by putting fillets in the weld bead, or to 80 to 90% of the original stock by sanding the weld bead flush with the rest of the surface. ***J. E. Breen and Arthur S. Dwyer.*** *ASTM Bulletin*, no. 234, Dec. 1958, p. 60-63.

3624 Ultrasonic Welding. Reviews progress that has been made in methods and applications. ***J. Byron Jones and W. C. Potthoff.*** *Aircraft Production*, v. 20, Dec. 1958, p. 492-495.

3625 New Techniques Improve Sheet-Metal Welds. Weld positioners and manipulators answer some of the problems of precision sheet-metal welding. *American Machinist*, v. 102, Dec. 29, 1958, p. 62-63.

3626 Projection Welding of Mild Steel. Revision of BWRA's code of practice on the projection welding of mild steel sheet. ***G. A. Phipps.*** *British Welding Journal*, v. 5, Dec. 1958, p. 549-552.

3627 Calculating Hot Cracking Resistance of High Tensile Alloy Steel. Effect of steel composition on hot cracking during welding. Adverse effect of C, P, Si, and Ni, and its control by the presence of Mn, Cr, Mo, and V. ***F. J. Wilkinson, C. L. M. Cottrell, and H. V. Huxley.*** *British Welding Journal*, v. 5, Dec. 1958, p. 557-562.

3628 Effect of Diffusible Hydrogen on the Mechanical Properties of Weld Metal. Experiments in which the amount of diffusible hydrogen retained in all-weld-metal test pieces was varied. ***P. D. Blake.*** *British Welding Journal*, v. 5, Dec. 1958, p. 565-567.

3629 Strength of Metal-Arc Welds in HP.$_{30}$ Aluminium Alloy. Effect of Porosity and Weld Shape. Tensile tests on metal-arc butt and fillet welded joints. ***D. F. Adams.*** *British Welding Journal*, v. 5, Dec. 1958, p. 568-575.

3630* Brazing—A Practical and Versatile Art. Details of some of the lesser-known brazing processes and how successful some of the applications can be. ***H. Thomasson.*** *Canadian Metalworking*, v. 21, Dec. 1958, p. 30 + 1 page.

3631* The Morphology of a Brittle Structural Component Formed During Resistance Welding of Low-Carbon Steels. (*In Czech.*) Morfológia krehkej štruktúrnej zložky vznikajúcej pri odporovom zváraní nízkouhlíkových ocelí. ***Dáša Hrivňák and Ivan Hrivňák.*** *Hutnické Listy*, v. 13, no. 6, 1958, p. 512-517.

3632* Resistance Welding Thick to Thick and Thin to Thin. One new machine forge welds ⅝-in. bars to 1¼-in. rods; another welds metal foil half as thick as a human hair. *Industry & Welding*, v. 32, Jan. 1959, p. 40-41.

3633* Semi-Automatic Process Speeds Welding of Long-Deep-Groove Joints. Semi-automatic CO_2 welding with flux-cored electrodes builds big press frames faster and makes design changes easy. ***L. J. McDonough.*** *Industry & Welding*, v. 32, Jan. 1959, p. 48 + 1 page.

3634 Fabricator Sets Up "Countdown" to Insure Top-Quality Welds. Instead of holding off inspection until the very end, inspection starts before the plate material leaves the supplier's mill. The stainless parts destined for a reactor cooling system get checked at each stage of production. ***R. F. Gurnea.*** *Iron Age*, v. 182, no. 22, Nov. 27, 1958, p. 65-68.

3635* Severe Wear of Pearlitic Steel Weld Metal. The value indicating wear was found for 39 different brands of hard-facing electrodes. The relation between the wear property and microstructure or chemical composition was complex. ***Sukemitu Ito, Kozo Honda, and Kikuzo Ishiyama.*** *Journal of Mechanical Laboratory of Japan*, v. 4, no. 1, 1958, p. 15-21.

3636 Ceramic-to-Metal Bonds. Summary of four processes—their advantages and limitations—most commonly used in metallizing ceramics. ***G. R. Van Houten.*** *Materials in Design Enginering*, v. 48, Dec. 1958, p. 112-114.

3637* How to Choose Arc Welding Plant. Presents characteristics of DC rotary generator sets, AC transformer welding plant, and DC rectifier units. *Metalworking Production*, v. 102, no. 47, Nov. 21, 1958, p. 2035-2042.

3638* Magnetic-Force Welds Join Vinyl-Clad Steel. Magnetic-force welding is suitable for fast production and produces strong welds with no harm to the coating. ***F. R. Park.*** *Metalworking Production*, v. 102, no. 48, Nov. 28, 1958, p. 2079-2082.

3639* Question and Answer on Rivet Application. Questions on the use of small rivets to reduce machining and assembly costs are answered. ***T. C. Buchanan.*** *Metalworking Production*, v. 102, no. 48, Nov. 28, 1958, p. 2091-2094.

3640* Automatic Arc Welding Remote Controlled. Circumferential and longitudinal welding are controlled automatically. ***F. Hirschmann.*** *Metalworking Production*, v. 102, no. 48, Nov. 28, 1958, p. 2095-2096.

3641* Repair-Welding. First Aid for Foundry Equipment. New techniques and improved welding filler alloys are now restoring damaged equipment, effecting savings in down-time and parts previously impossible. ***L. D. Richardson.*** *Modern Castings*, v. 34, Dec. 1958, p. 26 + 4 pages.

3642 Application of Structural Adhesives in Air Vehicles. A systematic and detailed discussion is presented of the advantages and disadvantages of adhesives. ***David L. Grimes.*** *North Atlantic Treaty Organization, AGARD Report No.* 181, 28 pp. (TL565 Ag11r Vis.)

3643* Eastman to Market Unique New Adhesive. Typical applications of Eastman 910 Adhesive, the unique bonding material introduced as a laboratory curiosity only a year ago, joins almost every kind of material from minerals to rubber. *Plastics Industry*, v. 16, Dec. 1958, p. 22-23.

3644 One Temperature for Successive Brazes. Tighter production control with special brazes allows multiple brazing without reducing operating temperature of the final assembly. Includes design advice that can limit rejects to 2%. ***G. D. Cremer and R. S. Mueller.*** *Product Engineering*, v. 29, no. 50, Dec. 8, 1958, p. 84-86.

3645 Riveting. I. Manufacture of light alloy rivets; calculation of assembly; riveting light alloys. (*In French.*) Le Rivetage. I. ***Paul Penel.*** *Revue de l'Aluminium*, v. 35, no. 259, Nov. 1958, p. 1125-1135.

3646* The Welding of Copper. Difficulties in welding owing to such properties as heat conductivity, cooling contraction, tensile strength, expansion, and oxygen content. Errors in welding. Applicability of gas-, argon arc-, or "Sigma" welding. (*In German.*) Das Schweissen von Kupfer. ***Otto Horak.*** *Schweisstechnik*, v. 12, Oct. 1958, p. 136-140.

3647* Fully-Automatic Butt-Welding Machine. Development of a fully-automatic flash-welding machine which is designed with a transformer suitable for a maximum cross-section of 62 to 77 sq. in. depending on the high-temperature creep strength of the steels to be welded. ***Friedrich Hoch.*** *Siemens Review*, v. 25, no. 6, 1958, p. 204-205.

3648* Electronic Controls for Multi-Electrode Spot Welders. ***Friedrich Hoch.*** *Siemens Review*, v. 25, no. 6, 1958, p. 206-207.

3649* Arc-Welding Transformers With D. C. Bias Control. Describes a system of pure electrical control of the welding reactor by means of d.c. biasing instead of mechanical adjustment on air-gap reactors. (*In German.*) Durch Gleichstromvormagnetisierung steuerbare Lichtbogen-Schweisstransformatoren. ***Paul Zwanzger.*** *Siemens Zeitschrift*, v. 32, no. 10, Oct. 1958, p. 701-706.

3650* Glue Joints Durable. Twelve-year tests on preservative-treated laminated timbers indicate that the preservative treatments have had no deteriorating effects on the glue bond. ***M. L. Selbo.*** *Southern Lumberman*, v. 197, Dec. 15, 1958, p. 171 + 5 pages.

3651 Automatic Riveting Speeds Aircraft Wing Assembly. Over-all manhour savings on the job: 26.6%. *Steel*, v. 143, Dec. 22, 1958, p. 68-69.

3652 Welded Rings Cut Costs. Proper steel and flash butt-welding gives performance like a solid piece. Microstructure is illustrated. *Steel*, v. 143, Dec. 29, 1958, p. 68-69.

3653* Pneumatic Technology to Aid Work in Welding and Forging Shops. Problems and possibilities of pneumatic-technical equipment in welding for forging shops. (*In Czech.*) Vzduchotechnika na pomoc práci ve svařovnách a kovárnách. ***A. Holzmann.*** *Strojírenská Výroba*, v. 6, no. 11, Nov. 1958, p. 496-499.

3654* High Frequency Heating Industry. Examples of the use of high frequency heating for induction soldering and hardening. (*In Czech.*) Vysokofrekvenční ohřev v průmyslu. ***K. Pfeifer.*** *Strojírenská Výroba*, v. 6, no. 11, Nov. 1958, p. 506-509.

3655* Joining Metals With Adhesives. Description of principles of oven and autoclave bonding. ***Nairn Ringueberg.*** *Tool Engineer*, v. 42, no. 1, Jan. 1958, p. 53-56.

3656* Metal Vacuum Welding. Description of electron welding apparatus and of welds obtained. Protection of the metal from the atmosphere. Concentration of considerable energy on very limited surfaces. Precision welding. Preventing heat from spreading through the entire part being welded; avoiding deformation. (*In French.*) Soudure des métaux sous vide. ***J. A. Stohr.*** *Vide*, v. 13, no. 75, May-June 1958, p. 163-171.

3657 Producer Gives Instructions for Welding Moly. Results of a six-year investigation by universities and aircraft fabricators into the welding of Mo. ***R. R. Freeman and J. Z. Briggs.*** *Welding Engineer*, v. 44, Jan. 1959, p. 38-41.

3658 Fire Prevention and Protection in Welding and Cutting Operations. Nine rules of safety are presented as a background for precaution in welding. ***Roger Cholin.*** *Welding Engineer*, v. 44, Jan. 1959, p. 57-58.

3659 Controlled-Atmosphere Arc Welding. Some of the general considerations of controlled-atmosphere arc welding, shielding systems open to the atmosphere, and systems closed to the atmosphere are discussed. ***N. E. Weare and R. E. Monroe.*** *Welding Journal*, v. 37, Dec. 1958, p. 1169-1175.

3660 A Simplified Approach to Calculating Design Stresses. Design methods for creating efficient machine weldments are described. ***Omer W. Blodgett.*** *Welding Journal*, v. 37, Dec. 1958, p. 1182-1192.

3661 The Value of Nitrogen as a Weld Backing Gas. Nitrogen backing gas may be substituted for Ar with little or no detrimental effect on some high-nickel and stainless-steel alloys. ***R. V. Anderson.*** *Welding Journal*, v. 37, Dec. 1958, p. 1193-1195.

3662 Joining of Zircaloy to Stainless Steel. Investigation undertaken to develop a zirconium-to-stainless-steel joint in heavy-wall tubing, the joint to incorporate a metallurgical seal which would not be attacked during long exposure to pressurized high-temperature water. ***J. B. McAndrew, R. Necheles, and H. Schwartzbart.*** *Welding Journal*, v. 37, Dec. 1958, p. 529s-534s.

3663 Further Evaluation of Ni-Cr-B and Au-18Ni Brazing Alloys. Tensile and impact properties of AISI 347 and of AISI 410 butt joints brazed with a Ni-Cr-B alloy and with the Au-18 Ni alloy. ***Winston H. Chang.*** *Welding Journal*, v. 37, Dec. 1958, p. 535s-542s.

3664 A Survey of the Bonding of Cermets to Metals. Brazing cermets to metals is complicated by the great differences in thermal coefficients of expansion and by the difficulty in finding braze metals which will wet cermet surfaces. Reviews metallizing history, joint design, joint materials, methods of wetting, methods of increasing braze strength, methods of correcting for differential expansion and other topics pertinent to the production of a strong high-temperature braze for cermets. ***G. R. Van Houten.*** *Welding Journal*, v. 37, Dec. 1958, p. 558s-569s.

See also: **3138** (heat treatment of welds); **3193** (notch toughness of weldments); **3332** (inspection of welds).

MISCELLANEOUS

3665* Toxicity and Fire Potentialities of Common Chemicals in Industry. I. Article is directed toward hazards in smaller plants having no regular safety engineer. ***Benjamin F. Postman.*** *Air Conditioning, Heating, and Ventilating*, v. 55, Dec. 1958, p. 65-68.

3666* The Use of Fractional Powers of Operators in Studying Fourier Series of Eigenfunctions of Differential Operators. (*In Russian.*) Ispol'zovanie drobnykh stepeneĭ operatorov pri izuchenii riadov Fur'e po sobstvennym funktsiiam differentsial'nykh operatorov. ***M. A. Krasnosel'skiĭ and E. I. Pustyl'nik.*** *Akademiia Nauk SSSR, Doklady*, v. 122, no. 6, Oct. 21, 1958, p. 978-981.

3667* The Statistical Method and the Philosophy of Science. Statistical theories and their effects on scientific disciplines. ***Harold Hotelling.*** *American Statistician*, v. 12, no. 5, Dec. 1958, p. 9-14.

3668* Using Vibration Industrially. I. Types of Vibratory Devices. Recognizing application possibilities and selecting suitable vibratory equipment for the job can lead to greatly improved operations. Basic types of vibratory devices and areas of application provides information useful in all types of industry. ***Lester R. Moskowitz.*** *Automation*, v. 5, Dec. 1958, p. 69-75.

3669 Behind the Coming Crisis in Technology. Predicts that the supply for technical manpower will not keep pace with the demand of research and development programs in the period 1960-65. Outlines the advantages and disadvantages in utilizing contract research agencies to ease personnel shortages. ***Lauren B. Hitchcock.*** *Chemical Week*, v. 83, no. 24, Dec. 13, 1958, p. 94 + 6 pages.

3670 The Patenting of Chemical Inventions. Requirements for patentability. Determination of scope in drawing up claims and specifications. ***J. M. Soesan.*** *Chemistry & Industry*, 1958, no. 50, Dec. 13, p. 1640-1645.

3671* The Notion of Components in a Directed Group. The notions of components and of projection were extended to directed groups which have the property of decomposition of the elements. Theorem of immersion in a certain product of components and two theorems in connection with the representations of the elements by means of the projections. (*In French.*) La notion de composantes dans un groupe dirigé. ***Romulus Cristescu.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 247, no. 20, Nov. 17, 1958, p. 1700-1705.

3672 Applying the Systems Approach to Warehousing. Five approaches to warehousing, progressing in complexity from a manual system to a computer-controlled arrangement. ***R. J. Marland.*** *Control Engineering*, v. 6, Jan. 1959, p. 65-70.

3673 A History of Technology. This fifth and final volume covers developments up to the 20th century. ***Charles Singer E. J. Holmyard, A. R. Hall, and Trevor I. Williams.*** v. V. 888 pp. + 44 plates. 1958. Oxford University Press, London. (T15 Si64h)

3674* On Some Elementary Properties of the Crossed Products of von Neumann Algebras. ***Masahiro Nakamura and Ziró Takeda.*** *Japan Academy, Proceedings*, v. 34, no. 8, Oct. 1958, p. 489-494.